The FOUNDRY

Volume 59
Number 18

Published
Semimonthly

CLEVELAND, OHIO, SEPTEMBER 15, 1931

Golfers Hole Out in Cups of Malleable Cast Iron

OH, the dirty little pill
Went rollin' down the hill
An' rolled right into a bunker.
And on the green I took thirteen,
An' then, by gosh, I sunk 'er.

So sing a large portion of the 4,000,000 people who play the ancient Scottish game in the United States.

The Insert Shows a Specially Designed Cast Cup

The so-called duffer who plays occasionally, but has not time for continued activity in the sport, regardless of his interest, is elated when he reduces his score from an average of seven to sixes and goes about with his head in the clouds when he breaks a hundred. Those players who play the course in the high 70s and low 80s are in the minority and are the players whom the duffer regards as phenomenal. However, regardless of the ability of the player, each tries to go around the course in the least number of strokes possible. The final objective on each hole is the cup. Cups on the golf courses are products of the foundry and commonly are made of malleable iron. As previously mentioned in this series, other equipment for golf and numerous other athletic contests also are made of castings. This is further evidence of the way the foundry industry serves the sport lovers of the world and aids in keeping Mr. Citizen in good mental and physical trim.

Find Where Castings Can Be Sold

CONTENTS

Feature Articles

	Page
Specializes in Stoves for Seventy-Six Years—By Pat Dwyer	26
Every Efficient Foundry Needs a Sales Manager—By Eric N. Simons	29
Prevent Losses With Proper Gates and Risers—By Pat Dwyer	33
Pattern Lumber Includes a Variety of Woods—By Norman F. Hindle	36
Melts Bronze in Crucibles—By Frank McKlveen and R. H. Stone	38
Progress Marks Malleable Casting Industry—By E. E. Griest	44
Bill Offers Advice on Cupola Operation—By Pat Dwyer	49
Will Test Alloy Gray Irons	51
Overloading Reduces Efficiency in Sandblast Barrel Machines—By Louis D. Peik	53

Regular Departments

Reviewing New Books	32	**Data Sheet**	48
Questions and Answers on Foundry Practice	41	**The Shakeout**	54
		Personal	55
Problems in Nonferrous Founding—By Charles Vickers	43	**What Others Are Thinking**	58
		What The Foundries Are Doing	59
The Foundry Family Photograph Album	47	**New Trade Publications**	59

THE FOUNDRY is published semimonthly by the Penton Publishing Co., Penton building, Cleveland, O. Member, Audit Bureau of Circulations, Associated Business Papers and National Publishers Association.

Branch Offices: Chicago, Peoples Gas building; New York, 220 Broadway; Pittsburgh, Oliver building; Cincinnati, Schmidt building; Washington, National Press building; San Francisco, Alto building; London, Caxton House, Westminster, S.W.1; Birmingham, England, 14 New street; Paris, 9 Rue de Londres; Berlin, Dahlmerstrasse 64A, Berlin Lichterfeld-West. Cable address, Irotrapen, London.

Subscription: United States and Mexico, $3.00 a year; Canada, $4 a year; Great Britain and other Foreign Countries, £1:0:0 a year; single copies 25 cents. Copies published three months or more previous to date of current issue, 50 cents each.

Copyright 1931 by the Penton Publishing Co.

Specializes in Stoves for Seventy-Six Years

By Pat Dwyer

PERHAPS in no branch of the foundry business is the gradual evolution toward style and perfection, style in relation to prevailing modes and perfection in construction and materials, more marked than in the important branch devoted to the manufacture of stoves and ranges. Stove foundrymen were among the first to specialize in the intensive production of one definite line of castings, a movement that gradually has spread into other sections of the castings field only in comparatively recent years. Mechanical equipment, apart from the usual tools and devices, and including squeeze machines, follow boards, matchplates and set gates, first was adopted in the stove making branch of the foundry industry. Due to the fact that the various parts were assembled with little or no machine work, a high degree of accuracy was essential in the final shape and dimensions of the many parts required to form the complete stove before it left the factory.

Fig. 1—Stove Top Is Poured Through a Single Basin Opening Into Two Sprues

Competition and, to some extent, the natural human urge toward the attainment of perfection, led the early stove masters to the adoption of methods and materials that would insure smooth and still smoother surfaces on the castings. Worship at the shrine of physical beauty in animate or inanimate objects, is not confined to the ranks of amateur and professional artists.

The man who evolves out of his mind the lines of a new and beautiful stove, who sees that stove take tangible form under the skilled hands of patternmaker, molder and fitter and finally emerge on the shipping dock, smooth, shining and graceful in every detail, that man derives—and who shall say he is not entitled to—as much pride as any artist, sculptor or painter in the contemplation of his work.

Stove makers were the first to realize the important relationship between the composition and condition of the sand, and the surface appearance of the casting. In the early days they had no scientific methods or apparatus for testing sand. They had to depend on the rule of thumb. Fortunately the thumbs were the pri-

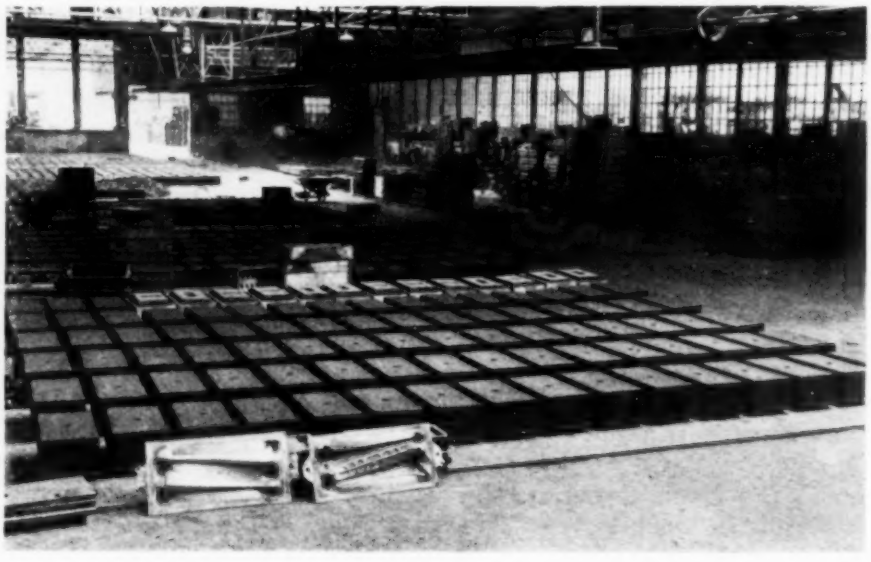


Fig. 2—Wide Gangways and An Elaborate Monorail System Facilitate the Distribution of the Molten Iron

vate property of shrewd, foxy gentlemen, who, in the language of the day, experienced no trouble in distinguishing between a hawk and a hand saw. In addition to the manager or head of the department, every molder represented an inspector and a committee of one, competent to pass on the merits or demerits of any given body of sand. A little over 100 years ago flat slabs ½-inch thick for the sides, ends, tops and bottoms of box stoves, were cast direct from blast furnace iron, in open molds the same as the pigs cast in the vicinity. Stove-plate today usually is only 1/10-inch and rarely exceeds ⅛-inch in thickness and is poured from a mixture containing three or four different varieties of pig iron to insure maximum strength, fluidity, adaptability to changing temperatures and uniformity in contraction. Many stove foundries can trace their term of activities back to the early years of the present century. A smaller number came into existence in the eighties and nineties of the past century. A few prominent plants were established in the Middle West during and immediately after the Civil war days.

Fig. 5—Stoves Are Assembled on Conveyor Lines Made up of a Number of Small Individual Trucks Mounted on Castors

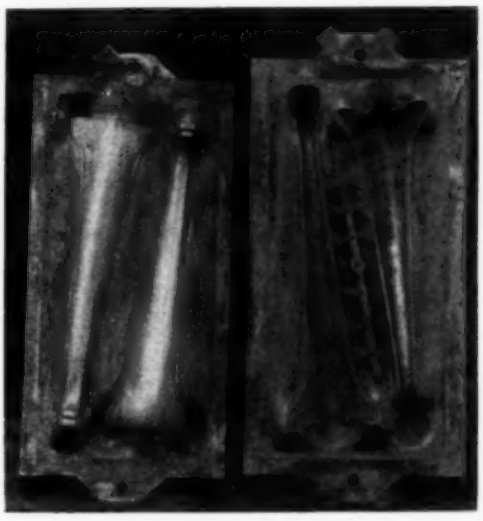


Fig. 4—Long Stove Legs Are Made from this Aluminum Pattern Equipment

The Walker & Pratt Manufacturing Co., Watertown, Mass., first was established in 1855 by G. W. Walker, and has been operated continuously since that time by members of the Walker family. At present A. W. Walker, son of the founder, is president and Richard D. Walker, third in succession, is treasurer of the company and overseer of sales and the factory. Connection of the Shaw family with this enterprise and with earlier foundry industry in New England is found in a reference in Henry R. Griffith's History of the Town of Carver, Mass. Johnathan Shaw ceded the land for a foundry in 1735. It is interesting to note that F. D. Shaw now is acting superintendent of the plant, in succession to his father, the late Bartlett M. Shaw, who died June 21 and who was connected with the company for the past 47 years. He in turn succeeded his uncle, the late Hon. Oliver Shaw, as general superintendent in 1895. Arthur W. Walker, president of the company since 1901, took service on the staff under his father immediately after he was graduated in 1882 from the Massachusetts Institute of Technology, Cambridge, Mass. Many employes of the plant have been in the service of the company for periods ranging from 30 to 45 years. Always of an ingenious, inventive and mechanical turn of mind, Mr. Walker seeks a change from his presidential duties in the exercise of his hobby, designing new

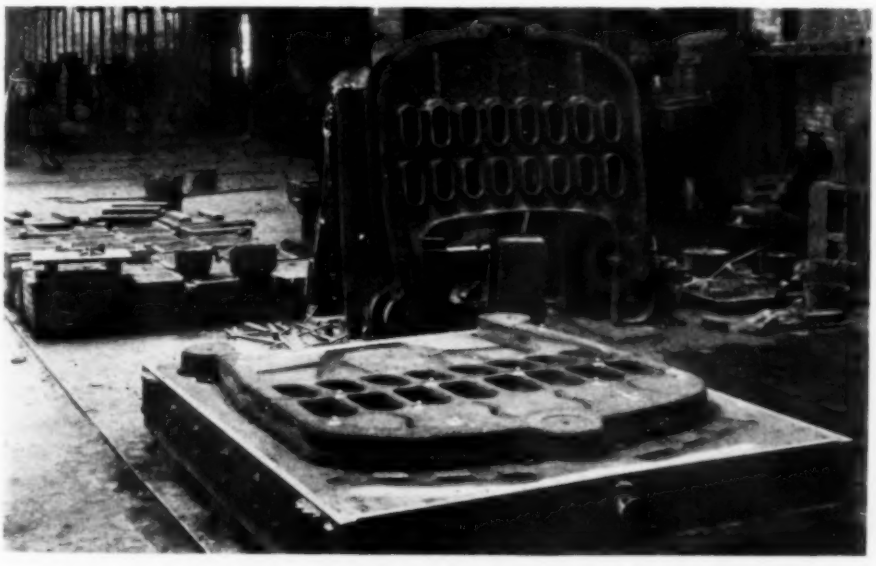


Fig. 3—One Section of the Foundry Floor Is Devoted To Boiler Sections

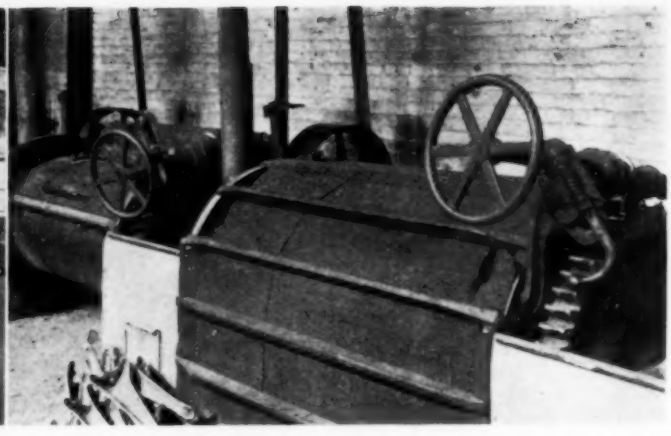


Fig. 6 (Left)—Electrically Heated Stoves Are Tested Under Current. Fig. 7 (Right)—Worm Wheel Device Turns the Barrel and Holds It At Any Desired Point for Loading and Unloading

stoves and designing improvements in the methods and equipment of the plant. For this purpose he maintains a den at his home fitted up with drafting appliances and all the other equipment and supplies essential to converting brain children into three dimension entities.

In his tours of inspection of the plant he is open to suggestions either from members of the staff or from the rank and file. He is fast physically and mentally and usually is about two jumps ahead of the man who advances a new idea. He can see the advantages and disadvantages before the final detail is explained and is prepared to either condemn and dismiss the scheme whole heartedly, or, to adopt it and proceed with immediate development. Competent, accurate, skilled and highly proficient in all branches of his business, he looks for the same attributes in those who are associated with him in the business and who are responsible for the details of operation, production and distribution.

Cramped quarters in the then existing plant prompted the management about 30 years ago to establish a large modern plant on a plot of ground that allowed for future expansion. This far seeing policy was justified in 1921, when despite a period of general business depression the foundry building was extended 160 feet and a large new building was erected and equipped with the necessary machinery for fabricating sheet metal parts that enter into modern gas and electric stoves and ranges. The present foundry building 122 x 560 feet also houses the enameling plant 122 x 160 feet. An electrically operated, continuous type enameling oven made by the Ferro-Enamel Corp., Cleveland, recently has been installed in that department.

Layout Still Is Modern

With the possible exception of a steam power plant—highly efficient at the time, but yielding in many plants in recent years to the electric motor, the gasoline and the diesel engine—the general layout and equipment of the plant were so ultra modern at the time of installation, that they still represent modern foundry practice. An interesting sidelight on a frictionless managerial policy is seen in an elaborate wash and locker room for the employes installed at a period when the usual accommodation was a nail stuck in the dusty wall on which a man might hang his coat.

The plant was laid out for straight line production and to that end the raw materials are discharged into a series of storage buildings which parallel the foundry building on the west side. This series of buildings is served by a railroad track on either side to facilitate the discharge simultaneously of various materials, coke, pig iron, core and molding sand. The coke is stored in a building with a capacity of 300 tons. Sand, pig iron and scrap are stored on the same approximate basis.

From the floors of the storage buildings, located 8 feet below ground level, the raw materials are loaded into narrow gage trucks and taken into the foundry through a series of tunnels. The coke and iron tunnels terminate at a point behind the cupolas where an elevator lifts the trucks to the charging floor.

Two cupolas 60 inches inside the lining are located at the west side of the building, approximately in the center, and the molten metal is distributed in 1000-pound ladles suspended from a monorail that serves all the molding floors. Each molder pours his own share of iron either direct from the bull ladle or with a hand ladle, but his work is facilitated greatly by having the iron brought to the gangway in front of his floor. A separate gang shakes out the castings and cuts the sand over in preparation for the following day's operation.

Castings are stacked in the gang-

(Concluded on Page 40)

Fig. 8 (Left)—Inscriptions of Various Kinds Are Placed on the Parts by a Transfer System. Fig. 9 (Right)—Automatic Control Involves the Installation of Elaborate Wiring and Switching Combinations

Every Efficient Foundry
NEEDS A SALES MANAGER

Successful Selling Must Be Aggressive— Maintaining Sales Is Only a Defensive Attitude

By Eric N. Simons

THE old conception of the method of making sales laid too much stress upon the *ales* part of the word. I am not a devotee of the *ales* school. Whoever is will not appreciate this article, and should seek comfort (and refreshment) where he will find more welcome views. I do not like the word merchandising, which has been imposed upon me. It is a long way of saying selling, and selling castings is my real subject.

The thing required is to *increase* sales of castings, not merely to keep them at their existing point, nor to prevent their declining. This may sound a platitude, but it is not. It is an essential point. Selling must, if it is to be successful, be aggressive. Maintaining sales is a defensive attitude. It may succeed in its object, but it will do little more. I take the point of view that the selling of castings should be an aggressive action, an action that is to say, in which the first and foremost aim is to win something one did not previously have, not merely to keep what one already has.

Selling Begins With Management

Aggressive selling begins with the management. Candidly, I am critical of certain foundry managements. There is, I perceive, a tendency to *kow-tow* far too much to the representative on the road. There is a tendency to imagine that, because a certain representative sends in orders with comfortable regularity, he is a tip-top man, and must be neither controlled nor instructed, nor in any way have his methods subjected to constructive criticism. In consequence, because his turnover may be, let us say, $100,000 per annum, as against the $50,000 annual turnover of some other representative in a different district, he is looked upon and treated as a star salesman, and in anything relating to his territory his word is law.

But the essential thing from the foundry management's point of view is not what that representative's turnover is, but what it should be. If the actual potential turnover for a given district is $200,000, then the $100,000-turnover man is not a "star" at all. If the actual potential turnover in the other man's district is $60,000, then he who secures $50,000 is certainly a star. By actual potential turnover I mean the amount of business that a firm may safely consider its legitimate share of the market, not the entire purchasing power of the market.

Selling Castings

SELLING is a pressing problem, not only of foundrymen in the United States, but of the foundry industry of every country. This article on selling is taken from a paper which was presented at the recent meeting of the Institute of British Foundrymen held at Birmingham and Coventry, England. It presents in an interesting, manner an Englishman's idea of the proper methods to be followed in selling castings in his country. But outside of a few factors governed by conditions not general to both countries, the American foundrymen will find the valuabe discussion directly applicable to his problem. The author is connected with Edgar Allen & Co., Ltd., Sheffield, England.

The *ales* school of representatives has this strong point, that by their methods they may, and generally do, secure a number of good old cronies, who, in the intervals of pulls at the beer-handle by the barmaid, give them excellent orders, and these orders, taken *in toto*, may tot up to a good turnover figure. In the old days it is possible, though I doubt it, that theirs was the best and simplest selling method. But today, in the face of tremendous industrial depression, the situation has changed completely. Modern buyers are, in the majority of instances, an altogether different race. With the development of mass production, with the increase of competition in all directions, it has been recognized that the buying department is one of the most important sources of profit or loss. A difference of a cent a pound in the purchase price of a commodity may, when translated into selling price of the finished product, decide whether the market is to be captured or not. Buying from a friend, for no other reason than personal friendship, is less practiced today than at any other period in industrial history.

Except where inefficiency reigns, buying is done on the principle that the firm offering the best materials at the most reasonable price and giving the most efficient and helpful service will get the orders. I stress here the factor of efficient service, to which I shall return later.

Study Is First Requisite

The first requisite of successful selling of castings is a close study of the market. At this juncture the management may well retort that its business is to manage, not to pore over blue-books and maps. It is not the management's business to make these investigations. The management's business is to see that they are made. The person whose business it is to make these investigations, not necessarily in person, is the sales manager. Every efficient foundry should have a sales manager. If the foundry is small, he may also be half-a-dozen other sorts of manager, and often is. The point is that there should be a directive influence over the representatives, checking, controlling, studying and stimulating them, measuring their achievements and preventing them from imagining, as they are only too ready to do, that truly they are the people. And that directive influence should be an individual, not a board of directors. Too often, if I may be iconoclastic, boards are wooden.

Fortunately, I can speak enthusiastically of a sales manager's value, since I am not one myself, but only a humble assistant, or perhaps humble is the wrong word in this connection. But what is of more interest is an outline of his functions. These I enumerate, without superfluous comment:

(1) To recommend changes of selling policy to the management, or to whoever is responsible for carrying on

the foundry, whenever such changes are necessary; or to confirm the policy already in force.

(2) To execute efficiently the policy decided upon.

(3) To analyze the market.

(4) To control representatives and agents, to check their results, and, where possible, to improve these.

(5) To sell the product actively.

(6) To make full use of subsidiary departments, as sales promotion, publicity, delivery department, statistics, etc.

(7) To draw up all agency and representative agreements, and to supervise all selling arrangements and contracts.

Space does not permit me to dwell upon the minutiae of sales management. For the present, therefore, I will turn to the important factor of market investigation. There are six main headings under which all market information may be grouped.

(A) What industries use or are likely to use the castings? (B) Do they all use the castings in the same way? If not, can they be grouped according to the use they make of them? (C) How are these industries situated? What is their relative importance in terms of capital and labor employed? How do they compare with each other in regard to the amount or numbers of the product they can absorb? (D) On what principles does each industry buy? (E) What is the best means of selling to each industry or group? (F) Will the castings suit each industry without modification of material, analysis, design, etc.?

Outlines Catechism

These form a satisfactory basis on which to build up the efficient marketing plan. I now turn to the subordinate, or, rather, more particular questions, of which a list is given:

(1) Is the product a novelty, a specialty, or a standard article? In other words, is it on the market for the first time, is it peculiar to one foundry alone, or is it a product widely known and used, and made by many competing foundries? (2) Is it a standard article in every industry in which it is used? (3) Are its applications standard applications in every industry? (4) What special features make it suitable for the various industries enumerated?

(5) Of what intensity is the competition? (6) What industry affords the greatest likelihood of rapid sales? Why? What obstacles do the other industries present? (7) Past, present, and probable future state of trade in each industrial market? Relation of this to volume of castings absorbed? (8) How do prices compare with those of home competitors? What is the relation of these prices to the savings, if any, that can be effected by the consumer using the castings? (9) Any foreign competition? Any competition from castings of a different character or composition, but fulfilling the same purpose? Any competition from forgings? How do prices compare in these instances? (10) What does it cost to pack and deliver the casting (*a*) to station, (*b*) to customers' works within various stated radii?

(11) Are the castings bought for direct use as an accessory to some other product, or as an integral part of some other product, into which they are built? (12) Are they bought for resale at all? (13) Is it necessary to carry stocks? If so, standard sizes? (14) Are the castings branded or labelled or marked? (15) Do the castings have to pass physical tests? If so, what, and by whom designed and carried out? Cost of these? (16) Who does the buying in each industry, and on whose recommendation are orders given out, such as purchasing agent, chief engineer, works foreman, production manager, etc.? Who buys when the castings are for resale? (17) Can repeat orders be obtained, or does each successful sale mean a customer dead?

Enables Scientific Planning

(18) Can orders be obtained for accessories or repairs? (19) Is service necessary after the castings have been sold, to ensure that the customer is satisfied? If so, what is this likely to cost in relation to the selling price? (20) What is the smallest order on which a worth while profit can be obtained? Will it pay to refuse orders smaller than that? What industry gives the largest average orders, and what is the size of these? (21) Is the sale constant, irregular, or seasonal? What factors govern the fluctuations of demand? Can demand be stimulated or influenced? (22) Percentage of sales costs in relation to (a) selling price; (b) profits; (c) total turnover? (23) Is it necessary or possible to sell through retailers? (24) Amount of competitive advertising? Its character? Media chosen?

A close and comprehensive review of his position, such as is furnished by this catechism, puts the founder in touch with every aspect of the market problem, and enables him to plan scientifically. From whom is all this information to come? There are various methods, all of which depend upon the size of the foundry, the extent of the investigation, and the purpose with which it is initiated. Special investigators may be sent out to study each market or group of industries and prepare a report. Statistical information furnished by various government reports and blue books may be judiciously combined with the information obtained on the spot by experienced salesmen. Valuable information may be obtained from business papers, and associations, their records and compilations, from the census returns, from trade directories, telephone directories, etc. However, this is of a generalized character.

A section of the market may be localized, and a preliminary campaign conducted against that section only, with the object of securing trustworthy guidance as to the reactions of the market as a whole by the behavior of one average section.

Whichever combination of methods is employed, the results obtained should be analyzed, tabulated, and charted carefully, so as to simplify presentation of the essential data. Consumption figures for each industry can be indicated clearly by graphs. Tabulation of sales data is another convenient form of presentation.

In addition to external investigations, the sales manager must make internal investigations, since an accurate knowledge of all the factors affecting sales is indispensable. He must obtain from the statistical section of the business, whether this be a sideline of the accounting department or a separate section on its own, certain details, as outlined in the following list:

Total sales in all departments of the foundry for the period he reckons as a unit, namely, one month or one year.

Total publicity and advertising costs for the same period.

Total sales of each individual department for the standard period.

Proportion of publicity and advertising expenditure absorbed by each department.

Total expenditure per standard period on selling costs, as distinct from publicity and advertising, for example, circularizing, salesmen's expenses and salaries, overhead charges, etc.

Comparative figures for previous periods in each instance.

Total number of new inquiries and new accounts over the standard period.

Total value of new accounts.

Many Facts Needed

Distribution of new accounts according to representatives' districts.

Percentage of new accounts and inquiries directly traceable to (a) advertising, (b) representatives' efforts, (c) catalogs and sales literature, (d) circularizing, (e) exhibitions.

Obviously, this list does not exhaust the facts the sales manager will need to know before his job is ended, but it is not my plan to dwell on details.

Having a fund of information of a fairly trustworthy character, the sales manager must, if the business be such as allows its selling policy to be regarded as a definitely consistent whole, decide upon a comprehensive sales policy, which can be expressed in concise form and circulated among the various persons and departments affected, all of whom should be invited to criticize or comment upon it. It will also be found a good plan to consult the service department of a business or technical paper of high standing.

It may be asked what a sales policy is exactly. The best answer I can give is that it is knowing what you want to do and deciding how you are going to do it. Every foundry has its own idea of a sales policy. Some have half-a-dozen different sales policies, and use them all, with chaotic results. But the clearer, more definite your notion of what you are out to do, the more likely you are to do it.

Then comes the actual execution of the sales policy, which may be called the sales campaign. Seven divisions of activity represent the fulfillment of a sales plan, as follows: (1) Outdoor selling; (2) advertising; (3) circularizing; (4) selling by printed matter; (5) expert demonstration; (6) exhibiting at fairs, trade shows, etc., and (7) overseas agency work.

Special Campaigns Desirable

Sometimes it is necessary either to put a new type of casting on the market, to give a general fresh impetus to sales, to clear out stocks, to extend the uses of the castings, to open new markets, or to stimulate falling sales. In such instances, it may be desirable to run a special campaign over and above the indinary selling activities, a kind of big push. This may involve special advertising, specially-prepared literature, extra circularizing, and even, where circumstances warrant it, a temporary increase of the selling force, or a reduction in prices.

In the course of these notes I shall not refer to these branches of selling activity in detail. For the moment I wish to concentrate specially on the question of foundry salesmen, because this, after all, is a matter that concerns every founder who employs outdoor representatives, and it is one of the most difficult and important problems to be solved in selling.

I have hinted earlier that foundry representatives of the *ales* school are definitely a race that is dying out, should die out, and must die out, for the good of industry. I have hinted, too, pretty plainly, that foundry managements have been inclined in the past to let their representatives build up for themselves fictitious reputations based on aggregate turnovers, without reference to market potentialities. Finally, I have declared roundly that representatives should be controlled, and controlled by an individual.

Representatives should be given clearly to understand that their first and foremost duty is to follow up as quickly as possible all important inquiries. This, of course, is A.B.C.

For the rest, they should not be allowed to wander at their own sweet will over the face of the globe. I hold strongly that a traveler's routes, subject to proviso 1, should be planned, not merely haphazard. I believe that there is everything to be said for certain districts, or, rather, the firms in those districts, being able to reckon on a visit from the foundry representative every certain period.

It often happens that a job crops up, for which castings may be suitable. The firm concerned, if it cannot count with some certainty on a visit from the foundry representative within, say, a week or so, will put the job out as an inquiry to various foundries. But if, by a process of quick calculation, the buyer or production manager can say to himself: "Oh, it is three months or so since Jones, of Brown's, was here. There was a card yesterday to say he will be calling sometime within the next week or so, I will have him in and put it up to him," the probability is that Jones will walk away with the order. This may not happen in a large number of instances, but if it happens at all, it is an argument in favor of planned routes. Planned routes enable the sales manager to send some sort of general notification to firms upon whom the representative will call. They enable him to fix appointments in advance.

The sales manager may plan the routes or the representative himself; but the sales manager should have a right to study and approve the representative's plan in the latter instance.

Prepare Firm List

Salesmen should not be allowed to let accounts lapse. They should be notified week by week of a limited number of firms, preferably the most important, who have not ordered castings over a given period. It should be made clear to them that they must call upon those firms during that week. The firms would, of course, be chosen according to the district the representative was likely to visit. Where the firms were small, or in out-of-the-way places, so that it would be inexpedient to compel the representative to visit them specially, the sales department should write to them, pointing out the decline in orders and generally trying to retain contact.

Looseness in the furnishing of expense accounts should not be allowed. All expense accounts should be detailed monthly under various headings. Failure to answer queries or letters should not be tolerated. Salesmen should not be allowed to spend what they like on presents and debit the foundry with the lump sum. If they wish to spend extra money in this respect, they should first indicate the sum they propose to spend, and ask permission.

From first to last, the technical salesman, which includes the foundry salesman, has to work by logic and reason. He must eliminate mere rhetoric from his equipment. To be able to convince the men he meets that his castings are worth buying, he must have a good deal of technical knowledge in addition to sales ability. He must be prepared to answer accurately questions of considerable technical importance.

The best technical salesman will sometimes meet questions they cannot answer offhand, but they should be able to convince the buyer that although they are not, perhaps, experts, they nevertheless know what they are talking about, and have not merely learned by heart a few technical facts and figures for talking purposes. They must be able at a pinch to suggest a slight improvement in design. They must have so thorough a knowledge of industrial methods and requirements that they can put themselves in the customer's place, and point out ways in which money can be saved by use of the appropriate castings.

The ideal foundry salesman is one who has had several years of good foundry experience, and possesses also those general qualities of vigor, confidence, imagination and tact, that make for salesmanship.

Salesman Material Available

Such men are not easily found. The trouble is that foundry managements have not paid enough attention to the need for trained and efficient salesmen of their goods. In consequence, they have taken no steps to secure or guarantee a supply. The young men in their drawing-offices have gone to various posts in the works or offices, without ever being made to realize the opportunities elsewhere. Yet hundreds of young men training to become engineers or foundry managers, none of whom will ever rise to more than an under-manager's position, if they do not remain in the drawing-offices, would, with a little training and encouragement, make splendid foundry salesmen. The foundry salesman does not need to be a foundry genius. He needs foundry experience and knowledge, the groundwork that many of these young men acquire as a matter of course, plus those qualities previously outlined. It is much easier for a young engineer to learn salesmanship than for a salesman to learn engineering.

The foundry management with foresight should instill into its young draftsmen, from the time they enter the drawing-office as tracers or runabout lads till the time when their inclinations and abilities are clearly perceptible, the notion that it needs a certain proportion of them to train for salesmanship. In this way the foundry will always have a reserve of eager young men with experience and foundry knowledge ready and willing to represent it in any part of the world.

The sales department should help the foundry salesman in every way possible. The salesman should be

notified immediately of any change of policy and he should meet the sales manager regularly for a discussion of urgent problems. The advertising department—nonexistent in most foundries, and regrettably so—should explain its proposed plans to him, and the reason for them. Every bit of market information the sales department receives should be forwarded without delay. The advertising department should supply representatives with copies of each new advertisement published so that they may be conversant with them.

Authentic testimonials are an asset any foundry salesman is glad to have. Duplicates of these should invariably be circulated among representatives. Works departments should supply the representative via the sales manager with new facts about the castings or the processes by which they are made, or the facilities for producing and stocking them. They should notify him of any changes in composition or application.

This article is concentrated primarily on the direct-selling end of the foundry business. I have carefully kept in the background such important matters as sales promotion, advertising, publicity, exhibitions, keeping of sales records, circularizing, expert demonstration and all the indirect aids to selling. My reason is that to deal with all these adequately would demand an entire book.

My experience has been that principles precede details. Granted the principle, and the details always can be worked out by competent people. But it is in their failure to admit the primary principles that too many foundries go wrong. They will not control their salesmen as they control their clerks or managers; study their markets; advertise; analyze their sales costs; secure consistency in their agency and selling agreements; furnish their sales force with ammunition in the way of selling points, prices, information and literature. Until they are prepared to concede that these things are in principle necessary, it is useless to go into elaborate plans for achieving objectives.

Reviewing New Books

Worth While Literature Covering Numerous Problems Pertaining To Foundry Practice, Management, Merchandising and Research

Revises Materials Book

Materials of Engineering, by H. F. Moore, cloth, 409 pages, 6 x 9 inches, published by McGraw-Hill Book Co. Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $4.15, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

This is the fourth edition of Moore's work and many important changes have been incorporated. For example previous editions contained one chapter on failure under repeated stress while the fourth edition contains chapters on elastic failure, failure by *creep*, and failure by fracture. In addition to a number of other changes, the new edition contains a chapter on the crystalline structure of metals written by J. O. Draffin.

The introductory chapter gives an outline of the various properties such as strentgh, stiffness, elasticity and plasticity, etc. which are encountered in studying engineering materials. Chapter II deals with cohesion, stress and strain, and Chapter III discusses the elastic failure of materials. Failure of materials by flow or creep and failure of materials by fracture are described in Chapters IV and V. Working stress, factor of safety and selection of materials are topics of discussion in Chapter VI, and the manufacture of iron and steel is briefly described in Chapter VII.

Iron and steel castings, rolling and forging, and welding are briefly touched upon in Chapter VIII. Chapter IX discusses crystalline structure and its relation to strength and ductility. Chapter X gives information on chemical composition of iron and steel, corrosion, and tables of strength values. Chapters XI, XII, and XIII deal with nonferrous materials and alloys, wood and brick, stone and terra cotta respectively. Cementing materials, concrete, and rubber, leather, belting and rope are discussed in Chapters XIV, XV, and XVI. Testing and inspection, and testing machines are described in Chapter XVII, and Chapter XVII discusses specifications for materials.

Outlines Diesel Practice

Modern Diesel Engine Practice, by Orville Adams, cloth, 6 x 10 inches, 656 pages, published by the Norman W. Henley Publishing Co., New York, and supplied by THE FOUNDRY, Cleveland, for $6, postage 15 cents extra; in England by the Penton Publishing Co., Ltd., 416-17 Caxton House, Westminster for 30s postage extra.

The book was written with the purpose of combining in one volume a text for study and reference and a practical manual for operation and repair, and has carried out this objective in admirable fashion. The author, as a consulting diesel engineer, has had wide experience in the problems of successful diesel operation and has assembled the material of the text from his experience in the field. All material is handled from an easily understandable and practical angle.

Describes Permanent Molds

Eisenguss in Dauerformen, by Friedrich Janssen, paper, 92 pages, 6 x 9 inches, published by Julius Springer, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, for $3, postage 15 cents extra. In London the book may be obtained from the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

From time to time articles have been published on the use of permanent or long-life molds in casting gray iron, but up until this time no effort has been made to write a book upon the subject. The author, therefore, is to be congratulated on his contribution to the literature, and upon his effort to explain the various factors and principles involved in the manufacture of permanent mold castings, and in the design of the molds. The author has had four years practical experience on the various phases of permanent molding, and in addition has made two investigational trips to the United States.

The book includes a historical account of the development of methods, and a description of the various methods that have been and are being used to produce permanent mold castings. The different types of pouring devices are discussed as are the design and construction of molds, operating temperatures of molds, service demands and wear of molds, and materials for mold construction. Composition of the metal, pouring temperature and melting operations are described. Discussion of materials used for castings is divided into two parts. One deals with castings that can be used without heat treatment, and the other with castings that are heat treated after leaving the molds.

New England Founders Hold Outing

The annual August outing of the New England Foundrymen's association was held Aug. 12 at the Pomham club, near Providence, R. I. Members indulged in both indoor and outdoor sports. Dinner was served in Rhode Island fashion at 2 p. m. An excellent time was reported. C. E. Andrews, Whitehead Bros. Co., Providence, is chairman of the entertainment committee.

C. P. Maxson, Auditorium Garage building, Cleveland, and Starr-Carpenter, Parks building, Pittsburgh, have been appointed representatives of the Conco Crane & Engineering Works, division of H. D. Conney & Co., Mendota, Ill.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

DUE to the rapidity with which molten iron solidifies when reduced to a thin section, the gating system on small castings usually requires more care and attention, than the system adopted on heavy or thick castings. Minor features are reflected to an exaggerated extent. The size and shape of the gate on a thick casting may vary within wide ranges, in many instances, without affecting the casting in any manner. A slight change in the position or shape of the gate on a small casting may spell the difference between a good casting and a piece of scrap iron.

Cold Sheets Appeared

A typical example illustrating this point is shown in Fig. 84. Changing the style of gate from that shown above to the style shown below effectually cut out all the wasters on the particular job. The casting is an oval shaped base 6 inches on the long diameter, 3/16-inch thick at the rim and with a rise of about an inch to a round pocket in which the upright member of the device later is fastened. The weight is a little less than 3 pounds.

The customer supplied the four aluminum patterns gated as shown in the upper part of the illustration. The upper surface of the casting as shown at *A* carried a series of flutes extending from the hub to the rim. A lacquer finish was applied later to the finished castings and if any surface imperfections showed through this coating, the casting was rejected.

Although the iron was poured at a high temperature, cold shuts appeared in at least one casting out of each group of four as shown at *B*. In many cases the molds were not filled completely.

The method of gating was changed to that shown in the lower part of the illustration with the four patterns grouped close together. This arrangement permitted the use of a Greek cross form of gate from which the iron had to run only a short distance to the extremity of each mold cavity. A marked improvement was noted when the change first was made and after a little further adjustment practically every casting was perfect.

In this instance the total area of the gate opening into the mold was not changed. The two small openings in the upper illustration practically equal the single gate shown in the lower illustration. The controlling factor was the total distance the metal had to travel from the bottom of the sprue to the farthest point in each mold cavity.

Cast iron piano plates as shown in Fig. 85 furnish a typical example of a wide class of castings into which the metal must be poured at a high temperature, from many points and at a high rate of speed. On account of the large area, the variation in thickness and the many ribs, the problem of warpage is one that enters extensively into the successful production of these skeleton castings.

The gates, from five to seven in number, are arranged strategically as shown in the illustration. Four to six branches on each gate insure a uniform and rapid distribution of the molten metal in the immediate vicinity. From five to seven streams of high temperature iron, poured from as many hand ladles and entering the mold from various points present a reasonable guarantee that the metal will fill the mold and that metal from the various streams will unite without any evidence of miss-runs or cold shuts.

Strip the Casting

After the metal has set in the mold, the cope is removed and the casting is stripped in a manner calculated to equalize the cooling speed as nearly as possible in all parts of the casting. Considerable experience is required before a person can be entrusted with this part of the work. This type of experience can be gained only through actual contact with the work, because in detail it will vary to some extent depending on the particular shape and general design of any given casting. Piano plate designers show almost as much versatility as the designers of the melodies to be played on the finished instruments. Frequently, also, the plates have many discords to their credit before they finally are hidden from view in ornate mahogany, rosewood or ebony cases. One of these castings that persistently shows a disposition to warp will cause more grief in a foundry than the ninety and nine models that are amenable to treatment, to skillful manipulation of the metal, position of the gates and subsequent stripping of certain parts of the casting.

Almost without exception these castings are paid for on a piece work basis and warped castings are not acceptable. With this incentive to spur him on or this potential penalty hanging over his head, the molder usually may be relied upon to take all the suggested precautions and then develop a few of his own to be on the safe side. Money may be the root of all evil, but experience seems to show that in nearly all cases it exerts a wonderfully stimulating influence on the productive and inventive faculties of those who stand to face a loss through their own fault.

Although regarded in many in-

The Responsibility

WHILE it is true that in some instances the shape or position of a gate is responsible for a defective casting, it is equally true that the same gate with perhaps some slight readjustment may be made to serve satisfactorily. Under certain conditions the gate receives the blame which justly should be placed on some other factor in the comparatively long list involved in the production of castings. Ring castings of various types are produced more satisfactorily where no copes are placed on the molds. Watching the metal rise in one of these molds usually proves to be an eye opener and an answer to the riddle of where the dirt comes from, dirt that is not discovered until the casting is partly machined.

stances as a factor om major importance, in fact the most important factor in the list, the gate in some cases really is of only secondary importance. Where one foundry pins all its faith on a top gate for a certain casting, a second foundry produces the same casting satisfactorily with a bottom gate. This is particularly true of castings subjected to extensive machining operations where the condition of the metal under the skin and in the interior of the casting is exposed to view. Other factors beside the shape and position of the gate are responsible for the homogenity or lack of homogenity in a wide list of casting presenting many features in common. The list includes piston and bull rings, bushings, sleeves and liners, cylinders, retorts, pipes, plungers, hollow rolls, etc.

Held to the Lathe

A typical casting of that kind, a bull ring made in various sizes, is shown in Fig. 88. Contrary to the impression conveyed by the name, the casting is not connected in any manner with the Spanish national sport or with the animal around which the sport revolves. The name has been adopted to denote strength, tenacity and endurance, characteristics usually attributed to the bull, and is applied to a casting which is shrunk on to certain types of pistons to hold the packing rings. The pattern is a plain ring designed to supply enough stock for at least two finished rings. Patterns for small rings are not provided with lugs. Large ring patterns carry lugs either on the inside or on the outside, as shown in the central figure, by which the ring may be attached to the face of the lathe or boring mill.

Two principal methods for gating these castings are shown in Fig. 88. Some men favor gating them on the bottom, but that method involves a little more work and therefore does not meet with popular approval. As a plain matter of fact, satisfactory castings may be produced under any of these gating systems. Conversely, any one of these gates will not produce a good casting if certain other features are not watched, and watched closely.

Proponents of the top pouring

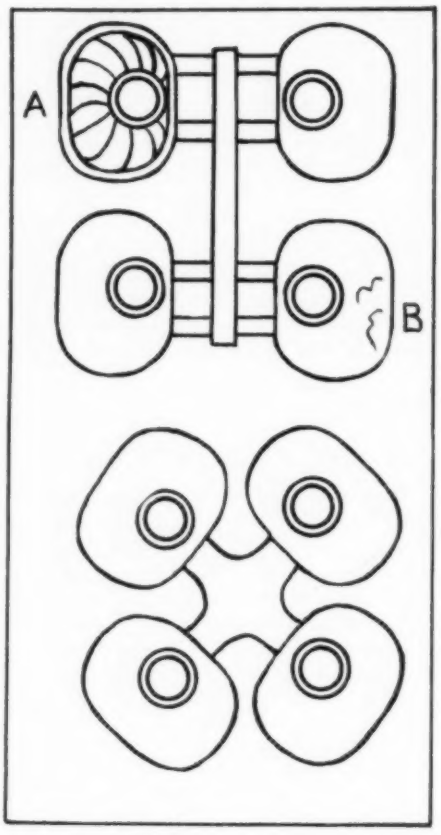


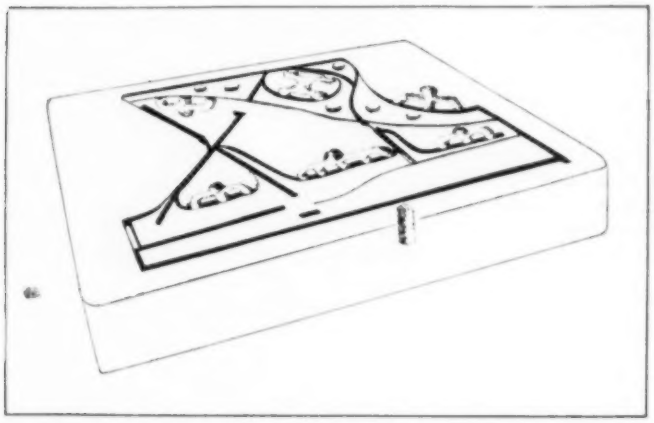
Fig. 84—Faulty Method Above Changed to Satisfactory Method Below

method shown to the left, claim that if the runner basin is kept filled, the iron entering the mold should be as clean as the iron entering the mold from the *storge* or skimmer gate shown to the right. Further, the hot metal dropping from a number of small pop gates will have a tendency to loosen any dirt that seeks to cling to the wall of the mold or core. Under certain conditions, these castings may be poured in a copeless mold and then any dirt that appears may be kept floating by the application of the end of a small rod. This point was covered in considerable detail in the ninth installment of the present series which appeared in the May 15 issue of THE FOUNDRY.

Favor the Open Mold

Where a man for some imperative reason is forced to pour these castings under a cope, then it is probable that the group of small pencil gates will serve more satisfactorily than either the single gate entering horizontally at the top edge or, a somewhat similar gate connected at the bottom. However, no type of gate will prevent the formation of dross in the mold itself if the mold and core are not perfect. For that reason the open mold is favored by many foundrymen. Shrinkage and sullage are taken core of by extending the mold upward several inches beyond the normal length of the required casting. The surplus metal is cut off later in the machine shop. The top of the casting also is provided with lugs for the convenience of the machinist as pointed out previously.

An open top mold in which any foreign material can be detected and kept floating with a rod, is a positive guarantee of a clean, solid casting. In many instances the presence of a cope on a ring mold merely represents a blind following of custom and tradition. A foundry owner or manager can consult his own convenience in placing a cope or omitting a cope on these castings. The foundry foreman or molder might find it worth while to consult his principal or customer with a view of omitting the copes on certain castings. A little irregularity or roughness on top of the casting is



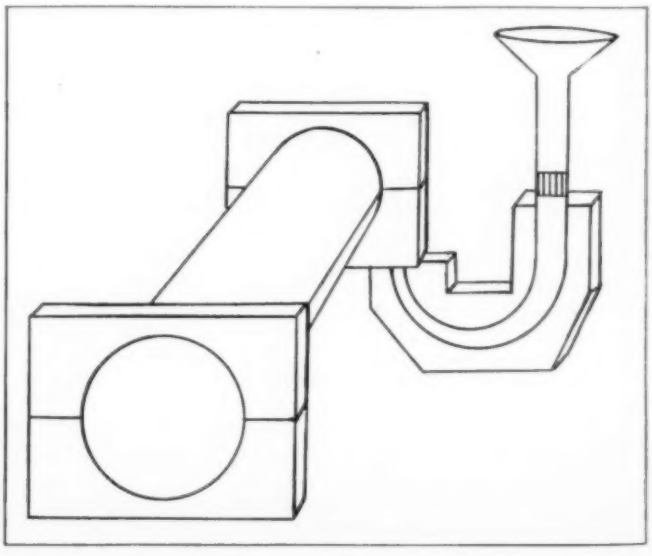


Fig. 85 (Above)—Typical Piano Plate Mold with Gates at Six Different Points. Fig. 86 (Right)—One Half Dry Sand Core Removed To Show Application of Horn Gate

a factor of minor importance. This part eventually is cut off in the machine shop and discarded.

An ill vented core is one of the most prolific causes of trouble in castings of this kind The metal will not lie quietly against it, but boils and bubbles with the consequent formation of a slushy compound that is partly sand released by the boiling action, and partly a manganese sulphur combination that always is formed when air or steam is driven through molten iron.

On a large, open body of metal this material readily floats to the top, but it has little or no chance to float in the narrow space between the inner and outer walls of a bull ring mold. Molten metal instantly develops a skin as it touches the cold walls of the mold. This skin may be compared to sticky fly paper in the manner in which it grips and holds foreign material floating in the vicinity.

Pick Wrong Culprit

The attraction in many instances is stronger than the force which keeps the foreign substance floating —the difference in specific gravity between the slush and the molten iron—and the result is that the metal rising in the mold, flows over and past the lump of foreign material.

Later when this defective area is uncovered in the machine shop, blame is placed on the gate, on the iron, on the coke, on the weather, on practically everything in fact, except the real culprit, a core which caused the iron to boil. Sufficient cognizance is not taken of the fact that the core is surrounded entirely with molten iron and for that reason maximum provision must be made for the ready escape of all the gas and steam generated in the confined area.

In one prominent locomotive building establishment cylinder liners are cast vertically in dry sand molds. The interior is formed with a loam core turned horizontally over a coating of hay rope on a cast iron barrel or arbor. The dried core is up ended and placed in the mold. Iron is poured into the mold through a ring of small pop gates formed in a flat ring core which also serves as a cope. The runner basin is built on top of the ring core.

This method is employed universally in the shops which specialize in the production of cast iron pipe according to what has been considered for many years the standard or orthodox process. The molds are made, dried and cast in a vertical position. The longitudinally split cast iron flask, hinged along one side is placed in a horizontal position while ejecting the casting. Then the two halves are snapped back into position, clamped and up ended and the flask is sent through the cycle of production again in an upright position.

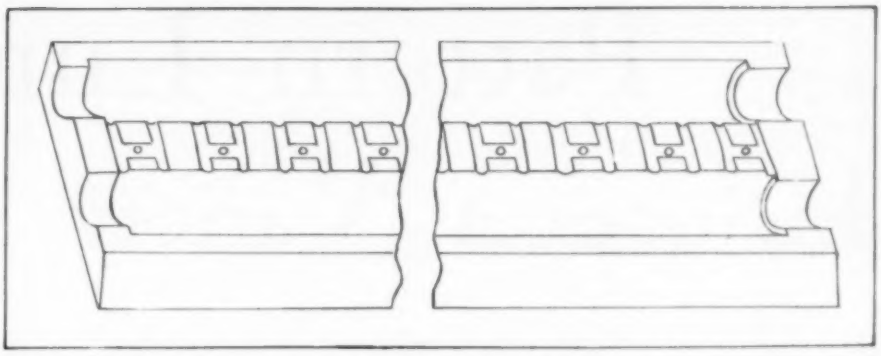


Fig. 87—Rapid Distribution of the Iron Is Assured Through 14 Sprues Each One Supplying a Group of Four Gates

Parenthetically a brief explanation may be presented to the effect that cast iron pressure pipe also is produced in considerable volume according to three other methods. In the first a stream of iron is poured into a revolving steel mold where centrifugal force forms the pipe without the necessity of using a core. In the second method the metal mold is lined with sand but in other general features the method resembles the first. In the third method the mold is made as in ordinary green sand practice with the inside formed by a green sand core swept on a cast iron or steel barrel.

The style of gating employed on the 16-foot pipe lengths made horizontally in green sand molds in a prominent southern pipe foundry is shown in Fig. 87. The illustration is a reproduction of a free hand sketch and makes no pretense to accuracy of dimension. It merely serves to convey an idea of the general features. The reader will note that the gates are arranged in groups of four, two to one pipe mold and two to the adjoining mold. Each group of four gates is supplied with metal from an individual sprue. A total of 14 sprues are located on a center line in the cope and are filled simultaneously with metal from a special type ladle provided with 14 lips. In this manner the iron enters each pipe mold through 28 gates spaced a few inches apart throughout the entire length.

Many advantages of this type of gate are obvious. The mold is filled almost instantly with metal at a practically uniform temperature. The relatively short distance each stream has to travel removes the hazard of sand erosion always present where molten iron flows over sand for a considerable period. With so many streams flowing from the ladle, it is not necessary to provide large or deep runners to supply the gates. This feature in turn helps to reduce the amount of iron required to pour each casting. Also the light runner solidifies before the casting and therefore does not *draw* metal to itself, a common form of defect in pipes gated at the horizontal joint

(*Concluded on Page 37*)

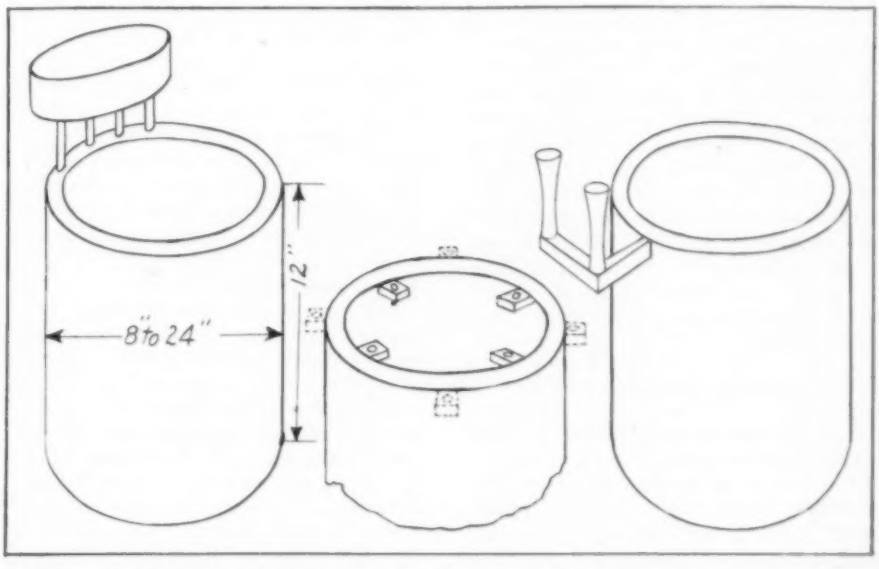


Fig. 88—Packing Rings Are Poured According to One of the Two Methods Shown to the Right and Left. In Some Instances Bottom Gates (Not Shown) Are Favored. The Lugs Inside or Outside Are for Attaching the Ring to the Lathe or Boring Mill

Pattern Lumber Includes a Variety of Woods

Many Woods Are Used in the Manufacture of Patterns and Each is Subject to Different Methods of Grading—Defects Also Are Classified Differently

By Norman F. Hindle

MAHOGANY, cherry, maple, beech and birch are the hardwoods probably used more for the manufacture of patterns than other woods of that type. They also are subject to grading rules standardized by the National Hardwood Lumber association, McCormick building, Chicago. Defects as given in the rules are much the same as those given for the soft woods. Standard defects include knots; splits; wane; worm, grub, knot and rafting-pin holes; etc. Each class of hardwood is subject to a separate set of rules, but generally are classed in the following grades: Firsts and seconds, which are sold as one grade; selects; No. 1 commons; No. 2 commons; and No. 3 commons. The same rules govern the inspection of beech, birch and hard maple while a different system governs cherry. African, Mexican and other Central American mahoganys, including the Honduras, which is known as baywood, are classed separately from Cuban. Mexican, Central American and African mahoganys are graded as follows: Firsts, seconds, selects, No. 1 commons, No. 2 commons, No. 1 wormy, No. 2 wormy, shorts and counters. Cuban mahogany is graded as follows: Prime, selects, rejects, shorts, wormy, counters and clear strips. Practically all grades of the hardwood mentioned contain considerable clear wood. The first three grades mentioned correspond closely to the B and better grade in white pine. First grades practically are all clear lumber.

Pattern Costs Reduced

One class of lumber cannot be used for all patterns required in a shop of any size. As an instance, it would be foolish to back a pattern with the same class of wood that should be used to make the finished face. The back stock should be of a lower grade than the facing stock. If the patternmaker is using B select or better stock as a backing for a pattern, when one of the common grades would be good enough, he is increasing his costs over what they should be because the common grades sell for less. If the condition is reversed and he is using a cheap grade for both backing and the facing, he is lowering his costs at the expense of pattern durability and also increasing lumber wastage. There is a class as well as a type of wood for each pattern and if patternmakers will give the problem the thought it deserves, it will pay in a decrease in costs of patterns, wastage of lumber and pattern repairs. There are places for the best, common and shop grades of lumber in patternmaking and a correct balance must be maintained to give lower pattern costs without sacrifice of durability.

Subject Is Controversial

The question of drying or seasoning is the basis of controversy among patternmakers. Some maintain that the only wood to use for patterns is the air dried variety and that kiln dried lumber is not satisfactory. Others claim that kiln dried lumber gives as good results as the air dried type. There are arguments in favor of both treatments. Regardless of the method used, the process must be carried out with extreme care. Improper seasoning may result in defects which cause serious trouble in pattern manufacture.

Lumber is seasoned for three reasons, namely, to reduce shrinkage, warpage and checking after usage; to make it less subject to decay, stain, mold, and attack by insects; and to reduce freight charges on lumber shipments. According to H. T. Purfield, *Wood Patternmaking*, seasoning means driving out the sap. The moisture content of a freshly cut tree may be as high as 50 per cent. After a period of correct seasoning that moisture content is reduced to 12 to 15 per cent. Under ordinary living room conditions that content is still farther reduced to 8 to 10 per cent. White pine with a 12 per cent moisture content has different properties from dry stock. That lumber under the conditions mentioned has a specific gravity of 0.38 and a modulus of rupture of 7900 pounds per square inch. Those properties are higher than under green conditions.

Air seasoning should be carried out in a shed which allows free circulation of the outside atmosphere but at the same time protects the lumber from rain, snow, etc. Lumber should be piled in such a way that the first tier of boards is several inches off the ground, supported at both ends and at a sufficient number of other places so that these boards are in the same plane. Each tier is supported above the other in a like manner but the distance between tiers is only an inch or slightly more. Boards are piled in that manner to keep the lumber straight during the seasoning period. The period of air seasoning usually is 1 or 2 years for thin section boards and as much as 4 years for heavy timber. After that period the moisture in the lumber has been reduced to the proportional limit that exists between the wood and the air. The sap also has been removed but the gums remain to give the wood greater strength and density.

Kiln Drying Explained

Kiln drying of lumber is carried out in an oven especially constructed for that purpose. That process is used for two reasons, to reduce moisture more quickly than by air drying and to reduce the moisture content below that percentage obtainable in air drying. It also is claimed that kiln dried lumber is less subject to deterioration; that the process causes pitch to come to the surface where it is dressed off and the remainder of the board is hardened; that the wood loses some of its capacity to hold moisture; that

lumber dried by that process causes less trouble in gluing; that less handling is required; that fungi are killed at the temperatures used; and that insects in the lumber are killed.

The process consists of placing the wood in specially constructed ovens where it is subjected to the action of air heated to 160 to 180 degrees Fahr. The air causes the outer fibres of the wood to lose their moisture slowly and allow that contained in the inner fibres to work outward. Thus the moisture is eliminated progressively. However, too rapid elimination of the moisture causes case-hardening, one of the reasons that kiln dried lumber has fallen into ill repute with some patternmakers. That is caused by the outer fibres of the wood drying too rapidly and shrinking. The shrinkage at the outer fibres is more rapid than at the core and the lumber has a dry outer structure which incases the moisture in the inner fibres so that it cannot get out. The result is a board with the inner fibres in a state of compression and the outer in a corresponding state of tension. Another claim against the kiln drying method is that it destroys some of the life of the board.

Case-Hardening Causes Trouble

According to J. M. Haley, THE FOUNDRY, Jan. 15, 1927, case hardening is the most common defect in seasoned lumber. It is the cause of warping and opening of joints. If lumber in a case hardened condition is allowed to find its way into a shop, it will cause a great deal of trouble. When the stock is planed and the outer fibres are removed, the compression in the inner fibres is relieved. That allows the inner fibres to lose their moisture. When that occurs they shrink and pull away from a joint or become so bowed that it is impossible to join two such pieces.

The proper method of seasoning kiln dried lumber is to take it from the kiln and place it in covered sheds in the same manner that air dried lumber is seasoned, and allow it to absorb the normal moisture content, approximately 12 per cent.

There are several points that should be of interest to the patternmaker in seasoning, storing, and cutting lumber. It is known generally that soft wood is more subject to swelling and shrinkage than the hard varieties. Consequently that point must be taken into consideration when both classes of woods are used in a pattern. Improperly seasoned lumber heavily coated with shellac, laquer, varnish, etc., will not prevent the pattern from warping or swelling. Coatings do not prevent changes in the wood, they only retard the progress of those changes.

Several points must be taken into consideration in storing lumber. It should not be set on end in a place where there is the slightest amount of excess moisture. Under such a condition the exposed end of the board absorbs moisture which causes it to swell and often split. On the other hand, if the board is used in a pattern, when the pattern is allowed to stand and the moisture containing parts dry out, the result will be a warped pattern. Green or water-soaked lumber should not be placed in a drying room. The result of such action should be obvious. Wood never should be located so that one side is exposed to the sun and the other to a damp atmosphere. The cells on the side exposed to the sun will give off moisture while the opposite side is absorbing it. The result will be a badly warped board with the dry side concave.

Two of the most important don'ts as far as the dressing of lumber is concerned are: Never dress lumber on one side only and do not split a wide piece of lumber to get two narrower pieces. If one or two cuts are taken off one side of a piece and five or six off the other, the piece will bow. That is because of the manner in which the piece is cut. One side of the piece will have more cells than the other. Those cells or fibres are in a state of tension. If the tension is removed more on one side than the other the piece will bow. The second reason is due practically to the same cause. There are more cells at the center of the piece and those are in a state of compression. When that force is relieved, the forces acting to keep the piece straight are unbalanced and the board becomes bowed.

The patternmaker must remember that regardless of the quality of workmanship, a pattern is only as good as the wood from which it is constructed. A combination of skilled workmanship and good wood is required to make a good pattern.

This is the second and concluding article on pattern lumber. The first appeared in the Sept. 1 issue.

THE EDITORS

Prevent Losses

(*Concluded from Page* 35)

and with deep or heavy runner passages behind them.

Manifestly a multi-lip ladle would be required to adopt the idea in its entirety, but under certain conditions a single lip ladle might be employed. A long narrow basin could be built on top of the cope to supply metal to a number of sprues set in a straight line. In this manner the basic idea might be adapted to serve many steps of castings. To the objection that this elaborate gating system means a lot of time and trouble, the obvious answer is that it is an insurance against scrap castings. In the final show down, every foundryman is bound to admit that the only part of his product with a salable value is the casting. The customer is not interested in the style, shape or weight of the gate or the metal required to fill it. He does not know, and usually does not care, whether the casting is poured through one gate or a dozen. Economy of operation is as commendable in the foundry as in any other business, but where the virtue of economy is extended to a point where it jeopardizes the successful production of the casting, it ceases to be a virtue and merely becomes one of the stepping stones leading across the comparatively shallow stream dividing the solvents from the insolvents.

Gate Causes Trouble

As opposed to the foregoing, the style of gate shown in Fig. 86 may be the cause of a defective casting, where a plain, simple gate at the side, or a small pop gate on the top would cause no trouble of any kind. However, in justice it must be pointed out that the type of gate in itself, is not at fault, but simply the manner in which it is prepared and applied. In castings gated in the manner shown, blowholes sometimes appear at the point where the metal first touches the core.

If the blowholes appeared all over the casting, one reasonably might assume that any one of three main causes was responsible: 1—The iron might have been oxidized in the furnace, 2—The mold or core might have been damp, 3—The cores might have been too hard and dense for the free egress of the gas generated during the pouring process.

However, where the blowholes are localized in the vicinity of the gate, they probably are due to a horn gate core that is too hard, or, a core made from sand bonded with a water soluble binder. A core of that character will absorb moisture from the sand and cause the iron in the immediate vicinity to boil and thus cause blowholes in the casting. This argument is based on the supposition that the mold is made in green sand. If the mold is skin dried with a torch it is essential that no wet blacking should be applied to the gate. The molder may apply the flame at the bottom and see it appear at the top, but that does not mean that there is a flame inside the gate. The air and oil pass through the gate passage and ignite again upon striking the open air. No heat is developed on the inside of the gate and the blacking does not dry. As a result, a violent ebullition takes place later while the iron is entering the mold.

This is the seventeenth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The eighteenth will appear in an early issue.—THE EDITORS.

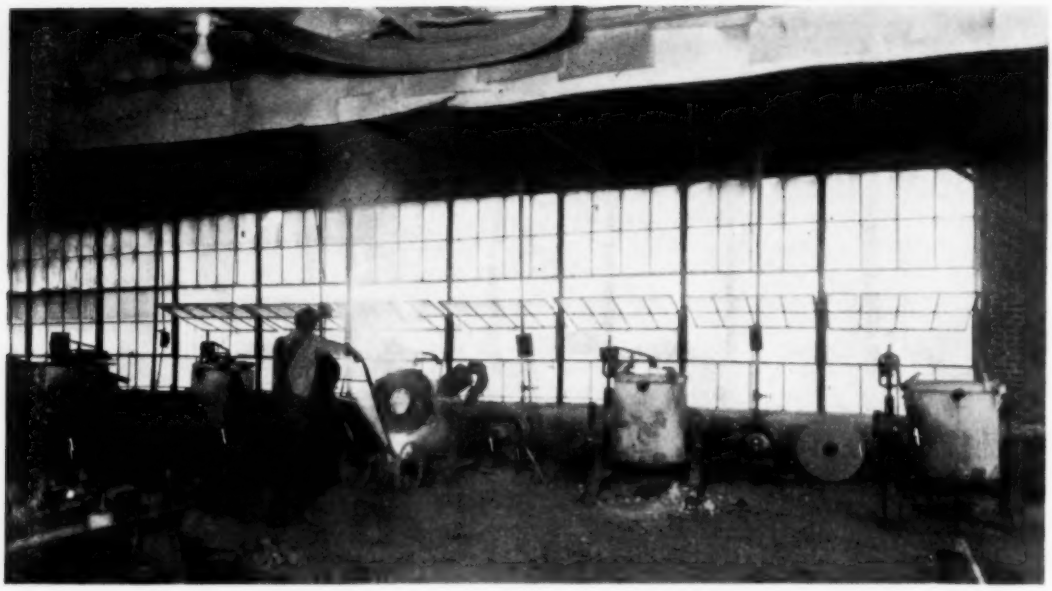


Fig. 1—Metal Is Melted in a Battery of Tilting Type Furnaces

Melts Bronze in Crucibles

By Frank McKlveen and R. H. Stone

THE drop in industrial activity has obliged plant managers to examine and test their equipment and processes for efficiency and adaptability to operations as a possible source of economies. Like many other concerns desiring to keep abreast of latest technological advances, the Robertshaw Thermostat Co., Youngwood, Pa., manufactures of widely used oven range thermostats, hot water controls and industrial temperature regulators, investigated many types of melting equipment, with the result that they have retained the tilting type crucible furnace using natural gas fuel. They have decided that this type of equipment gives them quality metal at low melting cost and, in addition, flexibility and ease of operation.

Require Perfect Surface

The Robertshaw company produces castings in 85-5-5-5 metal and as the majority of the castings are chromium plated, both polished and satin finish, the requirements of the metal are most severe. Any porosity on the surface of the casting will absorb the cleaning and plating solutions, which will then work out through the plate and cause spots. At that plant, the average rejection of castings for all causes runs below 8 per cent. As high as 3600 high pressure tested, water heater valve bodies have been made with only one piece rejected.

The foundry melting equipment consists of five tilting type furnaces made by the Campbell-Hausfield Co., Harrison, O., each taking a standard No. 125 Steele-Harvey graphite crucible. These furnaces are fired with natural gas fuel introduced through blowers made by the Maxon Premix Burner Co., Muncie, Ind., with no secondary air. A sketch of the furnace unit is shown in Fig. 2 and the battery of five furnaces is shown in Fig. 1. The center furnace is tilted over and shows the curved gas pipe entering a cylindrical combustion tube or chamber.

Melting Costs

TO PROVIDE an accurate check on manufacturing efficiencies, the Robertshaw Thermostat Co., Youngwood, Pa., recently made a careful analysis of the cost of melting bronze in its gas fired, tilting type, crucible furnaces. This article reviews the equipment and practices at that plant and gives complete information on the cost of the metal delivered at the molds for pouring. Frank McKlveen is foundry superintendent, Robertshaw Thermostat Co., and R. H. Stone is connected with the Vesuvius Crucible Co., Swissdale, Pa., and a member of the technical committee of the Crucible association.

In the illustration shown as Fig. 1, the motor and blower are supported on a bracket bolted on the trunnion-support casting to the right of each furnace. A 1¾-inch gas supply pipe may be noted coming down to the blower, with a valve just above the blower. This gas pipe discharges to the intake of the blower. The gas and air mixture is discharged into the blast pipe at the top of the blower. This blast pipe carries a swivelling joint in line with the trunnions. When the furnace is tilted the curved part of the blast pipe can rise with the furnace while the motor and blower remain stationary. The line is continuous without openings from the blower to the combustion chamber.

Furnace Design Important

Unusual economies in fuel consumption have been achieved as a result of a study of the particular requirements of the tilting type crucible furnace. In some installations of crucible furnaces using oil or gas fuel, the tip of the burner is too close to the crucible and not sufficient time or space is allowed for completing the mixture of fuel and air and for the liberation of the heat given off by combustion of the mixture. These conditions are aggravated if the burner is of a type drawing in secondary air around the burner port. This results in an excess of air in the gases in the furnaces, which chills the flame and shortens crucible and lining life by localized heating and cooling, and oxidation.

In the installation at the Robertshaw company, the mixture of gas and air from the blower is delivered to a

Table I

Metal Loss in Melting

85-5-5-5 Metal			78-2-7-13 Metal	
Charge	pounds	pounds	pounds	pounds
Heads	771.3		994.5	
Gate	1726.4		2005.7	
Ingots	3042.8		3002.3	
Total	5540.5	5540.5	6002.5	6002.5
Recovery				
Heads, Siftings, and Sweepings	351.5		537.7	
Gates and castings less sand corrections	5087.1		5347.1	
	5438.6	5438.6	5884.8	5884.8
Metal loss pounds....		101.9		117.7
Metal loss per cent		1.84		1.94

Table II

Itemized Cost of Melting

Fuel; 7500 cubic feet natural gas per ton at 45 cents per 1000 cubic feet	$3.51
Labor; 1 melter at $0.65 per hour 9 hours per day 1 helper at $0.40 per hour 4½ hours per day	1.52
Refractories; Linings at $12.00 each; covers at $10.00; combustion tube lining cement 30 pounds at 5 cents	1.17
General Maintenance; estimated at 20 cents per ton	0.20
Auxiliaries; 1 horsepower motor each furnace-current at 1.5 cents per K.W.H.	0.13
Depreciation; $2500 investment, 10 year life	0.18
Interest; 3 per cent on $2500 per year	0.05
Total cost per ton exclusive of melting loss or metal shrinkage	$6.76
Metal loss at 1.84 per cent and 12 cents per pound	4.42
Total cost of melting per ton including metal loss	$11.18

combustion tube attached to the side of the furnace as shown in Fig. 2 at *A*. Immediately on entering the tube the area is reduced and then again enlarged. This choking down helps complete the perfect mixture of the gases.

It should be noted particularly that no secondary air is admitted. All the air for combustion enters at the intake of the blower. The gas consumption with this type of equipment averages 7800 cubic feet per ton. Starting with a hot furnace 350 pounds of 85-5-5-5 metal can be melted ready to pour in 35 minutes.

Outlines Daily Practice

The shop operation for a day is as follows: The furnace tender starts work at 6 a. m. and first goes over the furnaces, patching and repairing linings where necessary. The furnaces, with crucibles empty, are lighted at 7 a. m. In about 30 minutes the first metal is put in the crucibles. This consists of a fill up of chips and turnings and is followed as rapidly as possible by the balance of the charge in the form of ingot metal, the weight of total charge being 335 pounds. All furnaces are ready to pour at 8:15 a. m.

A small amount of a soda ash-borax flux is added with the first charge. No further addition of flux is made and no cover such as glass or charcoal is used on the metal. That this is unnecessary may be explained by the perfect combustion conditions maintained. The flux and the chips are charged into the crucible with the cover swung back. The ingot metal is charged through the hole in the cover.

As shown in Fig. 1 the cover is tilted when the furnace is tilted, being held in place by clamps on the top ring of the furnace body. The cover on the tilted furnace is an old one as shown by the size of the hole. The new cover shown in Fig. 1 leaning against the wall between the first and second furnaces has a 6-inch hole.

The furnace is tilted by a segment gear and lever. A 50-pound pull is required to tilt the furnace with full crucible. The furnaces normally returns to a vertical position whether empty or full as soon as the lever is released. The metal is received in a ladle mounted on a low wheeled buggy. This ladle has a capacity of 175 pounds of brass and when filled it is wheeled over to an overhead system which picks up the ladle by trunnions and carries it over the molds. One end of the overhead track is shown in Fig. 1.

The desired pouring temperature is 2250 to 2300 degrees Fahr. The temperature is tested at the furnace and again just after the ladle is picked up by the overhead trolley. A pyrometer made by the Illinois Testing Laboratories Inc., Chicago, is used to determine temperatures.

Once a day the furnace man inspects the furnaces and makes necessary repairs and patches to the linings. Particular pains are taken to remove any slag around the base block, because an accumulation in the bottom of the furnace would interfere seriously with efficient combustion. The furnace linings are fire-brick shapes made to fit the furnace and all five furnaces can be relieved at a cost including materials and labor of about $60. The lining life is approximately 18 months.

Lining Is Rammed

The lining of the combustion tube or chamber is rammed in place using a silicon-carbide refractory, made by the Carborundum Co., Perth Amboy, N. J., in a semidry condition. A tapered wooden plug or mandrel is used as a core to form the combustion space and the refractory rammed around it. Of course, the end of the 4-inch plain type nozzle is in place and constitutes the form at the outer end against which the cement is packed. This cement takes a good cold set and after setting 3 hours the gas may be turned on gently. Full flame can be turned on after 3 to 4 hours with low flame.

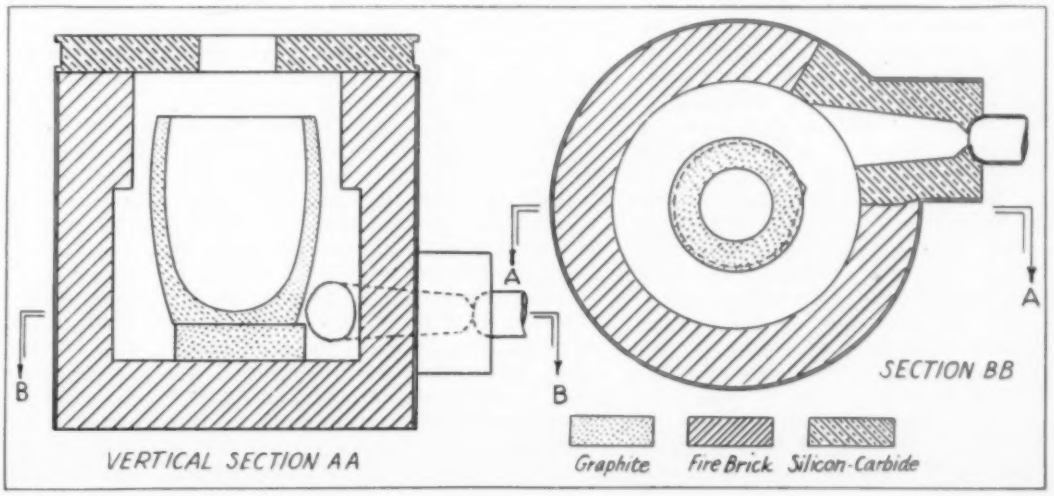


Fig. 2—The Mixture of Gas and Air from the Blower Is Delivered to a Combustion Tube Attached to the Side of the Furnace as Shown at A

Before discussing the various elements of melting cost, which, after everything else is said, is the item of greatest interest, some word is necessary defining the limits and qualifications of cost figures as applied to nonferous melting.

The cost of melting can be taken either as: (1) ready to pour out of the furnace, or (2) cost of metal delivered to the molds. Strictly speaking, of course, the cost of melted metal should be limited to metal ready to pour out of the furnace. However, in the case of the lift-out type crucible furnace no additional equipment is necessary to pour the metal and it is difficult to draw the line short of delivering the metal to the molds. Furthermore this is a point in favor of the lift-out type crucible and it seems only fair to place the limit on melting costs so as to give that method of melting the benefit of its inherent advantage. Therefore in figuring the costs of melting metal at this installation the authors have taken the cost of metal delivered to the molds.

Defines Metal Losses

In figuring melting costs, metal losses should also be defined as they are subject to the widest variations and have a large effect on the cost of melting. For example, if metal losses are determined by weighing a charge, melting it and pouring it into ingot molds and weighing the ingots the losses generally speaking will be low. On the other hand, if the losses are based on the shrinkage of metal charged to the foundry and unaccounted for they will likely be much greater. In this analysis the metal loss is determined by the latter method as detailed in Table I.

It should be repeated that these metal loses are on the whole foundry operations. Actual losses due to volatilization and oxidation in that type of furnace have on repeated tests been shown to be on the average about 0.80 per cent and never more than 1 per cent.

An analysis of the elements of melting cost listed in Table II shows the labor item consists of a furnace tender and one helper part time for pouring. Linings of furnaces including lining of combustion tubes and covers have an average life of 1200 heats. The linings are shaped fire bricks supplied by the furnace manufacturer, while the covers are the one-piece silicon carbide refractory type manufactured by the Lava Crucible Co., Pittsburgh. Depreciation charges are based on a 10-year life of the furnaces. Interest on investment is taken at 3 per cent per annum on the total investment which is an approximation of a 6 per cent rate on the average depreciated amount of the investment over the 10-year period. General maintenance is taken at an estimated figure of 20 cents per ton, which is an average of this item as determined in many other installations where this expense is segregated as a separate item.

This installation complete represents a total investment of $2500 and the normal capacity operating day shift only, is 1300 tons per year.

Specializes in Stoves

(*Concluded from Page* 28)

way where they receive the first inspection. Defective castings, sprues and gates are taken to the cupola platform. All the remaining castings are taken to the cleaning room where they are tumbled in an extensive battery of tumbling barrels installed by the W. W. Sly Mfg. Co., Cleveland. The ingenious hand wheel and worm device shown in Fig. 7 was designed by A. W. Walker and applied to all the tumbling barrels. This device enables the operator to turn the barrel to any desired position and lock it there.

After leaving the tumbling barrels the castings are chipped and ground and then separated into two main divisions. Those destined to be assembled without further finish are stored in an extensive series of racks close to the assembling floor. The remainder are sandblasted in two units supplied by the W. W. Sly Mfg. Co., and then taken to the enameling department were they are finished in any one of several standard colors.

Establish Piece Rates

Following an elaborate series of time studies, the work in all departments has been established on a piece rate basis recently with resulting economy of operation costs for the management and increased remuneration for the employes. Molding labor in this as in all stove plant foundries always has been calculated on that basis. In the enameling department sheet metal parts are paid for on a square foot basis. Payment for cast iron parts is based on the weight of the parts handled. The arrangement primarily is due to the fact that the steel parts present a plain and usually flat surface, while the surface of the casting usually is irregular.

Printed characters, the name adopted by the company for its product, dial faces, gages, etc., are impressed upon certain parts in an ingenious manner, a practical adaptation of the transfer pictures familiar to children. The prepared characters, printed in reverse on suitable slips of paper are pressed down on the enameled surface of the casting where they are located accurately by a suitable gage or guide strips. The casting then is plunged in a water bath which removes the paper and leaves the characters firmly attached to the face of the casting.

Legend and tradition are inseparable from any business in continued existence over a prolonged period. According to one of the traditions of the Walker & Pratt Mfg. Co., the name Crawford on its product is more than a name. It is a talisman, an omen, an amulet, the equivalent of a luck penny or a horse shoe. A proof, if proof is needed, that sentiment, an appreciation of beauty and a discreet belief in luck were not altogether unknown to the two enterprising hard headed young partners, Walker and Pratt, in the early days of the enterprise.

Chicago Will Be Scene of Safety Congress

During the week of Oct. 12-16, delegates of the metal industries of the United States will meet at the Stevens hotel, Chicago, to study methods of reduction of accidents and accident costs in those industries. The program is a part of the twentieth Annual Safety Congress and Exposition conducted by the metals, automotive and machine shop, and power press sections of the National Safety council.

The metals section will meet in four half-day sessions, one afternoon session of which will be devoted to safety problems in the foundry. The program for that session includes an address by Dr. Leonard Greenburg, Yale Medical school, on "Cleaning in the Metal Industry," an educational film and a motion picture showing the conveyorized foundry system of the General Electric Co.

The exhibition will be held in the exhibit hall of the Stevens hotel where more than 100 exhibitors will display standard safety equipment and developments in safety appliances. Articles of interest to the foundryman will be included.

Gives Elastic Data

The engineering experiment station of the University of Nevada, Reno, Nev., has published a bulletin entitled "Tables of Elastic Properties of Alloys," by C. H. Kent. It is a compilation of data gathered from various sources showing the composition and elastic properties of the more important steels and nonferrous alloys. The endurance properties and the variations under high temperatures of some of the alloys also are included. Copies of the bulletin may be obtained from the university for 20 cents each.

Bath Tub Orders Up

Orders for bath tubs in July totaled 46,704 units, compared with 43,228 in June. Purchase of sinks increased from 49,928 in June to 51,341 in July. July was the fifth consecutive month that the orders for bath tubs showed an increase.

Questions & Answers on FOUNDRY PRACTICE

Makes Molds for Glass

We are searching for a good heat resistant alloy for use in the manufacture of glass factory castings. Can you give us a list of the ferous and nonferous alloys used for this purpose, also practical instruction for mixing and casting these alloys. We have the analysis of a nonferous mixture said to be particularly suitable for these castings: Copper 63.40 per cent, nickel 20.35 per cent, zinc 7.29 per cent, iron 0.80 per cent and aluminum 8.06 per cent. We shall be pleased to receive information on the physical properties of this metal.

We have no knowledge or record of the copper-nickel mixture to which you refer. However, with one exception, we see no reason why a metal of that kind might not serve satisfactorily. It belongs to the broad class known under the generic name of German silver, hard, tough and heat resistant. The single objection refers to the cost of the metal as compared to gray iron. A change from gray iron to the nonferous metal in your foundry would entail considerable change in your melting and molding practice. The high nickel content would entail the installation of a furnace capable of attaining exceedingly high temperatures, several hundred degrees higher than that achieved in any of the regular type brass melting furnaces. Ordinary sands and methods suitable for molding brass and iron castings will have to be replaced by sands and methods employed in the steel foundry.

You are by no means alone in a search for a super metal suitable for glass factory molds. The ideal metal is one that may be machined readily and yet present a smooth and glass hard surface, a metal that will expand and contract readily and yet one that never will develop a crack, a metal that may be exposed to high temperatures over prolonged periods, and yet will not grow, a metal that will not stick to the hot glass, and yet a metal that will not produce fish scales on the surface of the glass object. Briefly it may be said that the ideal metal—from the customer's viewpoint—must contain many contradictory qualities, not the least of which are that it must compete in price with the commonest form of gray iron and yet must last in service practically forever.

Nearly every manufacturer of glass factory molds has developed a formula of his own for the metal mixture, but with minor variations all the formulas fall within the following limits: Silicon 1.65 to 2.30 per cent, sulphur maximum 0.10 per cent, phosphorus maximum 0.30 per cent, manganese 0.60 to 0.70 per cent, total carbon 3.50 to 3.75 per cent. The variation of the elements is due to the metal thickness of the various castings. Some foundrymen use from 10 to 15 per cent charcoal pig iron in their mixtures. Others prefer using a similar amount of an iron containing perceptible amounts of nickel and chromium. In other instances mixtures are made from various combinations of pig iron and scrap with additions of nickel and chromium made in the ladle.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

Q & A

Volume Is Too High

We have a 50-inch cupola lined down to 32 inches inside with mica schist being used to maintain that dimension. We are using a positive blower to supply the air, and it operates at 120 revolutions per minute with a displacement of 33 cubic feet per revolution. We have been advised that the blower supplies too much air, and it probably is affecting the physical properties of our iron through oxidation. To satisfy ourselves we installed a volume meter and pressure gage which show 3500 cubic feet per minute and 15½ ounces pressure. Six 4 x 7-inch tuyeres are used in the cupola. We are using a 34-inch coke bed weighing approximately 700 pounds, and an iron to coke ratio of approximately 11 to 1 in intermediate charges. The iron is hot, possibly around 2800 degrees Fahr. which we require, and the melting rate on our 1-hour heat is between 4 and 4½ tons per hour.

According to calculations your blower is supplying 3564 cubic feet of air per minute using a factor of 10 per cent for slippage which agrees well with your volume meter register of 3500 cubic feet per minute. However, that quantity of air is greatly in excess of that called for in good cupola practice. With an iron and coke ratio of 11 to 1, and melting 4 to 4½ tons per hour, between 725 and 825 pounds of coke are being burned in that period. Assuming that 132 cubic feet of air are required to burn 1 pound of coke, you will require between 1600 and 1800 cubic feet of air per minute. On the basis of 24,000 cubic feet of air per ton of iron melted which would apply with high iron to coke ratios, the amount of air to be supplied per minute happens to be the same as in the other calculation.

Therefore, it will be necessary for you to reduce the air supplied to your cupola by slowing down the blower to about 60 revolutions per minute, or put a blast gate in the pipe line between the blower and your volume meter by which you can regulate the quantity of air supplied.

MALLEABLE

Duplex Malleable Iron

Can you give me any information on whether any firm is duplexing malleable cast iron with a cupola and air furnace where the cupola iron is run directly into the air furnace without the intervention of a ladle?

We know of one firm in this country that is using the process outlined in your inquiry. The cupola is approximately 20 feet from the air furnace, and about opposite the stack of that unit. A long spout or trough connects the two units, and the molten metal enters the air furnace near the stack exit. The air furnace hearth is divided into two compartments by a wall, and these are called the first and second refining zones. The first refining zone is that occupying the portion near the stack, and where the metal enters. The second refining zone is that toward the firing end of the furnace. Molten metal from the first zone is conducted into the second by troughs or spouts on either side of the furnace which form bypasses around the interior wall separating the two compartments.

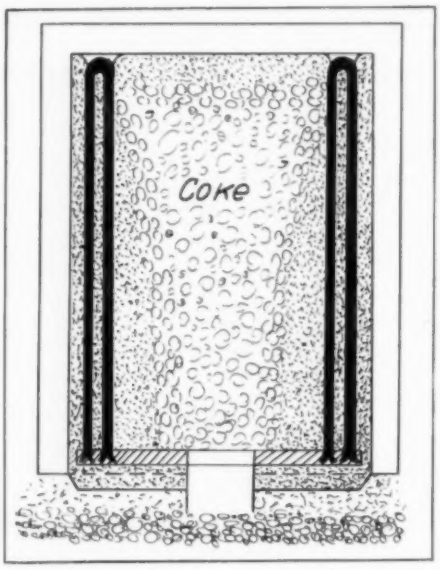
A desulphurizing agent in powdered form is said to be injected into the cupola at the tuyeres. It is claimed that duplexing with the cupola and air furnace reduces the time for a 20-ton heat from 4½ hours in regular practice to 1 hour and 40 minutes.

GENERAL

Cores Scab on Top

I am having trouble with the cores scabbing on top in a casting somewhat resembling a lathe bed, but with the top covered with a plate about 2 inches thick. The casting weighs 7000 pounds and takes six cores each 30 inches deep and 26 x 26 inches in cross section. The vent from these cores is taken through a coke bed in the bottom of the mold and the vent appears to come off freely, but when the core is removed from the casting later, the inside top surface of the casting is covered with scabs. The cores are made from a sand mixture containing one barrow load molding sand, 2 barrows fine river sand, 1 barrow load shop shop sweepings, bonded with a liquid core binder. The river sand is dirty. I have recommended a coarser grade of river sand and a dry binder and the elimination of the shop dust. I shall appreciate your opinion and advice.

Since you present no data on how the core is made and dried we are inclined to the opinion that these factors, instead of the mixture, are responsible for the scabs on the inner face of the casting. Properly dried and adequately vented, the mixture you have outlined should serve satisfactorily. The alternative mixture you suggest also should make satisfactory cores under similar conditions. A scab on the face of a casting is caused by gas or steam which cannot escape readily through the sand at the back and therefore forces a chip from the face and then



The Preferred Way to Make the Core

escapes through the molten metal. Apparently in your case the final volume of gas generated when the metal covers the top of the core cannot escape rapidly through the core itself. Therefore, a certain amount pushes its way through the top face of the core and in so doing lifts chips from the face of the core. Obviously the proper remedial measure to apply is one that will insure the passage of all the gas through the core itself down to the coke bed under the mold and thence to the atmosphere through pipes or tiles provided for the purpose.

A possibility exists that the cores are made in a corebox containing a bottom. If that is the case they are rolled over and as a result the ultimate top face of the core rests on the plate and never becomes properly dried. Again, it may be that a solid mass of core sand is rammed in the corebox instead of a coke center surounded by not more than 5 or 6 inches of sand at the sides and about 2 or 3 inches at the top.

The preferred and incidentally, the easiest, way to make the core is shown in the accompanying illustration. The illustration of course shows the core in position in the mold, but it also shows the lifting hooks and the cast iron arbor. Instead of a corebox with a bottom, an open corebox, one without top or bottom, is placed on a core plate. A 2-inch thickness of core sand is spread over the plate inside the box and then the arbor is lowered into place. Four loose, beveled pieces of wood are used to form the taper on the core print. A piece of 12-inch pipe, a wood block or an empty water pail is placed over the hole in the center and the sand is rammed to a height of 10 or 12 inches. Then the pipe, the block or the bucket is removed and the opening is filled with coke. The process is repeated until within a few inches of the top. Then the pipe is removed permanently and a layer of sand 2 or 3 inches thick is rammed into place, scraped off flush and shallow openings are dug around the lifting loops. When this core is dried in the oven, the top part receives the maximum drying effect and that is as it should be. Cores made and dried in this manner will not scab.

Q & A

One Piece Iron Flask

We are preparing to make cast iron flasks for use on a bumper and we are undecided whether each flask should be a one-piece casting, or made up of several parts bolted together. One of our men claims that the one piece castings are more cheaply made. Also that in bolted flasks the nuts work loose and require constant attention. A second man favors the built up flask. He claims the construction cost is less and that the completed flask will weigh at least 10 per cent less than the one piece flask. His strongest argument is that if the flask should be broken a part can be replaced more easily than an entire flask.

Practically all the cast iron flasks in use on jolt machines are of one piece construction. With the single exception that the one piece flask cannot be repaired as readily as a flask made up separate side and end pieces, every other feature connected with the manufacture and use favors the one piece flask. The advantage presented by a flask that may be repaired easily is only slight. Cast iron flasks, with ordinary care, remain in service almost indefinitely. The difference in rigidity between bolted flasks and one piece flasks is not an important factor where the molds are made on the floor and the sand is rammed by hand. However, conditions are radically different where the flasks are subjected to the action of a jolt machine in some instances only once, but in other instances several times each day. The pattern cost for a one piece flask where the flanges and sometimes the entire outside are formed in dry sand cores, probably is no greater than the pattern expense incurred in making single patterns for the ends and sides. The total cost of the four part flask, including the cost of the bolts and the labor for assembling, usually is greater than the total cost of the one part flask. With proper care in molding, the one piece flask actually should weigh less than a similar flask made up of four parts.

Problems in Nonferrous Founding

By Charles Vickers

Soldering Bronzes

We are producing aluminum bronze castings for one of our customers and he experiences difficulty in soldering these to brass castings. Some of the aluminum bronze castings tin satisfactorily, but others do not. The alloy is a straight 90 per cent copper, 10 per cent aluminum bronze.

Soldering of aluminum bronzes depends largely upon the aluminum content. With up to 5 per cent aluminum in the bronze, usually no difficulty is encountered in soldering with the usual methods of tinning and tin-lead solders. However, when the aluminum exceeds 5 per cent, the aluminum bronze should be plated with copper or nickel at the points where the soldering is to take place. The plated portions then are tinned in the usual manner.

Electrodeposition of the copper or nickel undoubtedly will give the most adherent coating. However, a satisfactory coating of copper may be deposited on aluminum bronze by immersing it in a strong solution of copper sulphate. The bronze is touched with a soft iron rod at the point where the coating is desired. In a short time, a deposit of copper appears, and when the surface is well covered, the bronze is removed from the sulphate bath. The piece is rinsed carefully in water to remove any adhering sulphate solution, and dried. The coating is brightened, and tinned as in the case with metallic copper.

Q & A

Aluminum Has Pits

We have had considerable trouble with pits and bad color in aluminum castings. We are using a molding sand supposedly blended for use on that type of casting. For the metal we use about three-fourths cast scrap and one-fourth 98% aluminum in our mix. The metal is melted in a crucible using a gas fire. The castings are used in our shop for patterns as a rule, and as a number of them are blanks for cut gear patterns, they are quite often heavy in cross section.

A molding sand for aluminum castings has to be of a fine grade to ensure against castings with the surface of a rasp. At the same time the sand must be highly permeable, so that the steam generated by the molten metal in drying out the mold will find it easier to pass into the sand of the mold than into the metal. If the latter condition prevails, pits and blowholes are inevitable in the castings. If any doubt exists as to where the steam goes, it is highly important to find out. To do that, make an open mold of the sand, rammed as it is rammed for the castings, and mold a flat plate. Such a casting will blow if anything will. Pour at the regular temperature.

A little *shivering* of the molten aluminum can probably be offset in the case of the molds by working the sand a trifle dryer, and ramming a little softer. Aluminum molds must not be rammed hard in any event. Neither a pene nor a butt rammer should be used in a shallow cope or drag, simply use the hands. If a jar ramming machine is available on the bench, about three or four raps will do all the ramming necessary, especially on the drag. If aluminum bottom plates can be used, cast them well perforated, with slots narrow on the face side, and well flared to the bottom side, so they will make their own cores easily. The drag half of a mold is always a problem in venting. The tendency of the steam is to rise, whereas, in the case of the drag, it has to be driven downward.

Keep the pouring temperature as low as possible. For a gear blank pattern, the liquid metal should show silvery and not red, the latter being too hot. It may be necessary to use chills at certain points to equalize the cooling of the casting. Keep the temperature of the metal while melting at a blood red, and charge cold metal when the preceding charge has sunk down.

The cast scrap must be freed from oil and grease before melting. Some wash it with gasoline but we would suggest a trial of kerosine as less dangerous. The oil when burnt off forms carbon, which forms carbides when the metal gets too hot. It also acts as a catalyst to form nitrides, which cause pits in the castings. It would be more economical to use new metal for pattern work, instead of scrap.

Gives Flux for Bells

We are having considerable trouble in casting a 12-inch locomotive bell, and recently we found that several foundries had given up this job because of similar trouble. We will appreciate any help you can give us. The casting is simply a common locomotive bell, which must be free of all holes, even pin holes. Holes appear on the outside, near the shoulder on the bottom part of the bell. On some the holes circle the ridge of the bell, while still others appear where the gate enters the mold. We gate this mold with four feeders running to a large pouring gate. The pattern is made for a green sand mold, and we have poured the metal very hot, also, on the cool side, but we are unable to get good castings. On the 10-inch size we have little trouble though. Our mixture is 82 copper; 18 tin; and the bells must polish after grinding.

It looks as though the trouble is caused by the molding. The sand is rammed too hard for the grade and the flask is too tight to permit the escape of the gas. The author has made scores of such bells in No. 1 Albany sand, but believes that is a trifle too fine and would rather use a No. 2 grade. A coarse sand will not cause a rough casting if the latter is heavy. If there is any danger of the casting being rough, rub on plumbago until the mold is polished like a stove.

There does not seem to be anything wrong with the metal, but to be sure, use the following flux: Yellow prussiate of potash, one pound; white sand, one pound; soda ash, one pound and borax, one pound. The flux is added to every 100 pounds of bell metal at the time that the metal starts to melt. When melted, the mixture is stirred well and the metal is allowed to remain in the fire 5 minutes. It is important that the flux be added as the metal melts so that it will get heated and the water of crystallation will be driven off the prussiate of potash. On new metal, add the flux to the copper before the tin is added. This will deoxidize the metal and also greatly improve the tone quality of the bell. The flux was first introduced by Charles H. Poland and was made public by the late Erwin S. Sperry.

Progress Marks Malleable Castings Industry

By E. E. Griest

FOR the first 100 years after the discovery of the malleablizing process by Reaumur in 1722, all malleable castings were of the white heart variety. In that process, white iron castings are packed in iron ore and subjected to high heat for a considerable period, during which most of the carbon is removed. Castings produced by that process are limited to thin sections, mostly less than ½-inch in thickness. Until about 10 years ago, all malleable castings produced in Europe were of the white heart variety. In the past few years, European engineers awoke to the superior qualities of black heart malleable as produced in this country and foundries for the production of that type iron have been established in England, France and Germany.

Industry Is Important

In 1826, while Seth Boyden, an iron founder of Newark, N. J., was attempting to duplicate the product of Reaumur, he discovered that a malleable casting could be produced from a white iron casting by a process different from that used by Reaumur and that the fracture would be black and silky instead of white and steely. He did not understand the metallurgical phenomenon, but learned how to produce this material consistently. In the early days, the castings were used mostly for harness buckles, wagon and carriage parts. Later, with the development of agricultural implements, malleable castings played an important part. Still later the railroads became the largest user of malleable castings and continued to be until automobile production began to run into the millions.

H. A. Schwartz defines malleable castings as follows: "Malleable cast iron is ferrite and temper carbon. It will be noted that this product differs from all other ferrous materials, containing only free carbon and free iron. Further, it is the only material containing temper carbon and the only cast material containing ferrite and no pearlitic or other form of combined carbon."

The process starts with an extremely brittle white iron casting composed of pearlite and cementite. In this state, the crystalline grains are large and castings contain internal strains. Those castings then are annealed for a long period, the length of time depending on temperatures used and local conditions such as size and type of ovens. The annealed or heat treated castings have an extremely fine grain and are free from internal strains.

Practices Improve

SINCE the discovery of the method of making blackheart malleable by Seth Boyden in 1826, the malleable casting industry has provided constant improvement in practices and product. This article, which is abstracted from a paper presented at a meeting of the Quad-City Foundrymen's association, discusses the gradual improvement in physical properties of malleable iron, adoption of modern equipment in the melting, molding, coremaking and cleaning departments and the accuracy that has developed in the annealing process. The author is vice president in charge of manufacture, Chicago Railway Equipment Co., Chicago.

Malleable iron has some interesting characteristics. The Malleable Iron Research institute has recommended to the American Railway association that it adopt specifications incorporating a yield point figure of 35,000 pounds per square inch minimum, and a minimum elongation of 18 per cent. Modulus of elasticity of malleable iron is approximately 26,000,000 pounds. Machinability is high and the grain size is fine. Constituents always are diffused properly and consequently the castings are free from segregation, internal strains and have equal strength in every direction. Surface finish of malleable castings in excellent. Corners and impressions may be made sharp and well defined. Malleable iron has the ability to withstand great abuse in service. Surfaces can be cast smooth and can be adjusted cold to fit, thus avoiding machining many castings.

Much progress has been made in the development of methods for control of the product so that uniform physical properties may be expected. Twenty years ago, methods were not exact in many foundries and specifications at that time called for an ultimate strength of 40,000 pounds per square inch and an elongation of 2½ per cent in 2 inches. Specifications gradually have increased until today many producers are willing to accept orders on the basis of the following minimum values: Ultimate strength, 55,000 pounds per square inch; yield point, 35,000 pounds per square inch; and elongation in 2 inches, 18 per cent.

Gives Physical Properties

That these figures are conservative and represent minimum values that may be met in every day practice, is illustrated by the following data giving results obtained by one foundry. The minimum results of 910 consecutive heats are: Ultimate strength, 56,490 pounds per square inch; yield point, 37,210 pounds per square inch; and elongation in 2 inches, 22.6 per cent. Average results for the 910 heats are: Ultimate strength, 58,344 pounds per square inch; yield point, 38,494 pounds per square inch; and elongation in 2 inches, 25.9 per cent.

Those high results are obtained without sacrificing any of the desirable qualities for which malleable castings have long been noted.

Some of the practices followed by progressive foundries producing high strength malleable are: Pig iron purchased on basis of definte analysis and checks made; before heat is tapped preliminary analysis is made and corections then made if necessary; samples are taken from first and last ladles and analyzed for essential elements; many melting furnaces now are fired with powdered coal which permits close control; annealing ovens are built carefully using best insulating materials; numerous thermocouples are installed to insure proper temperatures in all parts of oven; and high grade chemists and metallurgists diligently follow the process of making iron through various processes to insure production of a uniform product.

Equipment for melting always has been and always will be an important factor in the operation of a malleable foundry. In the early development of the production of malleable castings,

melting was done in crucibles. Obviously, the cost was high but a high quality product could be assured because the molten metal did not come in contact with the fuel and thus pick up objectionable elements. In the absence of metallurgical knowledge and without methods of analyzing for important elements, the crucible method provided exact control of the product. When, by trial, a mixture was found to be satisfactory, it could be duplicated by melting the same amounts and kinds of raw materials again. That process never was used extensively in America.

The operation of the cupola for makig malleable castings is much the same as for making gray iron except that in the former the proportion of fuel to iron is considerably higher. For light castings requiring relatively low physical properties, cupola malleable proves entirely satisfactory. That process is used by producers of pipe fittings. The use of cupolas in connection with other equipment recently has been exploited and is being used in several large production foundries.

The introduction of the air furnace permitted the entire charge to be melted down, held until properly refined, and then poured with assurance of the same quality in all castings. It gave melters the opportunity of reducing carbon, silicon and manganese if necessary by control of secondary air, and it permitted the increase of those elements by additions of coke and ferroalloys. The practice of using steel for reducing carbon also was introduced with the advent of the air furnace.

Firing Methods Investigated

Air furnaces are of the reverberatory type. The roof, which deflects the heat against the charge, is made in the form of bungs which are removed for placing the charge. In the early furnaces, coal was burned in a conventional fire box, the flame thus produced was drawn through and over the charge by the draft of a stack placed at the opposite end. The early furnaces all were fired by hand. Malleable foundrymen keep abreast of the times and, as new methods were developed by combustion engineers for getting better efficiency from boilers by improved firing methods, those devices were tried in modified design for firing air furnaces. Hand operated and power driven mechanical stokers, which had proven successful for stoking boiler fire boxes were tested and experimented with but without success.

The use of oil for firing air furnaces has been given consideration. It was contended by many that inasmuch as oil has proved so satisfactory for almost every kind of metallurgical furnace, it should be adapted easily to the air furnace. Many foundries tried it but relatively few persisted to the point of making it a success. As late as 1922, H. A. Schwartz in his book *American Malleable Cast Iron* made this significant statement, "as far as the author knows, the use of oil never has been generally satisfactory owing to the difficulties of maintaining the proper furnace atmosphere free from excessive air of CO_2."

Firms advocating the use of oil did not take into consideration the effect of burning oil in the same chamber with molten iron. However, several foundry organizations have persisted and have been rewarded by establishing practices which permit the use of this fuel successfully.

Tapping White Iron from the Air Furnace

Soon after the cement industry found pulverized coal suitable for burning cement clinker, the copper and malleable iron industries conceived the idea of burning that fuel in reverberatory furnaces. Experiments were conducted in both industries at about the same time. At the beginning of the experimental work, little was known as to the proper preparation of the coal or the proper kind of coal suitable for pulverizing. The early experiments proved conclusively that sufficiently high temperatures could he obtained and controlled readily. Some difficulty was experienced in controlling carbon, and generally the experimental equipment was not built for continuous operation.

Soon after the war, with the price of coal high and the desirable quality frequently difficult to obtain, several foundries gave consideration to the installation of pulverized coal equipment and the results proved satisfactory. Until recently, practically all installations have been of the central station type, and even now the central station design is considered most satisfactory for most foundries. However, some foundries have found unit equipment entirely satisfactory. With the central station type of equipment, the coal is delivered to the plant in hopper cars. The doors are opened and from there the coal is handled mechanically to the furnaces where it is mixed with the proper amount of air and burned with good efficiency.

Open-hearth furnaces have been installed in a few malleable foundries. These originally were built for use with natural gas. When that fuel became scarce, and consequently high in price, fuel oil was substituted. While open-hearth furnaces have been successful, they have not found universal favor because they are most efficient when operated continuously. That practice has been found desirable in few malleable foundries.

Electric Furnaces Installed

Several electric furnaces have been installed in malleable foundries. In the triplex system, the iron is melted in a cupola, refined in a converter and then superheated in an electric furnace. One foundry is melting directly in an electric furnace. The charge consists of a small amount of pig iron, malleable scrap and a good percentage of steel scrap of various kinds and borings. This furnace is operated 24 hours per day. At regular intervals, 1500 pounds of iron are run out and 1500 pounds of charge added.

Another interesting development is a rotary furnace developed at the J. D. Brackelsberg plant, Milspe, Germany. One furnace of this type is in production in a gray iron foundry in America and another is being installed in a malleable foundry. The furnace consists of a large steel barrel lined with refractories and fired with pulverized coal. As it slowly revolves, the charge comes in contact with the highly heated lining.

Molding equipment of latest design is used in malleable iron foundries. Sand slinging machines are in use in at least 4 foundries. In the typical malleable foundry, molds are small and are set out by the molders. In others gravity roller conveyors have been found satisfactory. In a few large production shops, power conveyors used in connection with continuous pouring practice are proving satisfactory. Some elaborate experiments with permanent molds have been conducted but without sufficiently good results to warrant adoption for general production work.

Pouring generally is done by the molders from land ladles. While it is still the practice in some foundries for molders to catch iron at the furnaces, in most foundries the iron is delivered to the floors in buggy or overhead ladles. Where power mold conveyors are in use, the pouring is continuous and the iron is delivered to the pourers in large ladles. For some work the pouring is direct from ladles holding from 400 to 1000 pounds of iron. In some foundries not using conveyors regular pourers are used. In that case, the heats are staggered so as to keep the pourers continuously employed.

The core room of the average malleable foundry is a highly developed department. Most castings require at

least one core and some require several. All modern core making appliances are in use. Core ovens are generally of the batch type but some continuous ovens are in use. The baking is done with coal, coke, pulverized coal, oil, gas, steam and electricity.

Sand is still cut by hand in some foundries which in others, gas or electric motor driven machines are used. The use of mechanical handling and conditioning equipment is being adopted rapdly. The importance of sand control has not been overlooked, in fact it has been emphasized and few foundries are now without proper testing equipment.

With the production of malleable iron having high physical properties came the necessity for close control of temperatures in the annealing cycle. Ovens are of the batch and tunnel type. If of the latter design they are fired with gas or oil. If they are of the batch type, they may be of the pot or muffle design. This type is fired generally with pulverized coal or oil. Some gas fired ovens have been used. B. J. Walker used pulverized coal for that purpose in 1896. Two foundries are using electrically heated ovens and because of this feature and the design which permits quick cooling through certain portions of the cycle, castings are being processed in a total of 72 hours.

In the cleaning department, tumbling barrels of the batch and continuous type are found. The barrels are arranged so that castings can be handled in and out with a minimum expenditure of labor. Generally, sandblast barrels are used but some foundries catering to large work have table equipment and rooms.

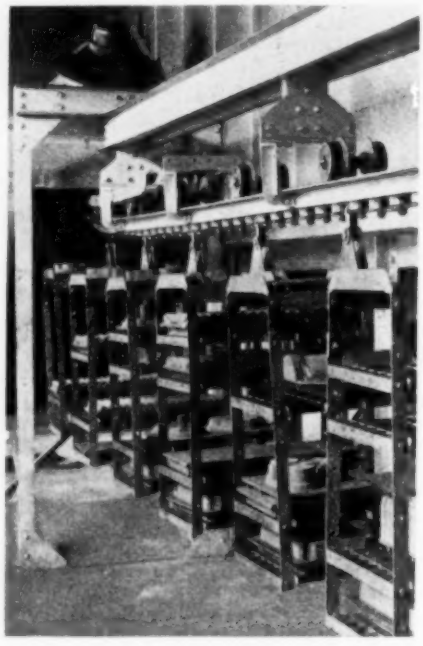
Sprue cutters have been adopted from the brass and steel foundries for removal of gates and risers from certain kinds of castings. Sometimes miling machines are found to be more efficient for the removal of gates. While some foundrymen still have some old style grinders, many installations of high speed variable speed machines have been made.

Gray Iron Shops Show Gain in Orders

For the first time in 3 months, gray iron foundries showed an increase in the amount of new business secured, according to the Gray Iron institute, Cleveland. Volume of new business increased from 40.1 per cent of normal in June to 45 per cent in July. The institute points out that the condition is rather unseasonable and probably reflects the fact that industrial concerns are being compelled to replenish stocks of castings to care for normal increases in business during the coming months. Production declined slightly from 53 per cent of normal in June to 50.6 per cent in July. The percentage of unfilled orders on hand at the end of July was approximately the same as a year ago.

Personnel Is Changed

Several additions have been made to the staff of the Worthington Pump & Machinery Corp., 2 Park avenue, New York. Otto Nonnenbruch, for the past 4 years chief engineer, diesel department, I. P. Morris & De La Vergne Inc., Philadelphia, and prior to that for 9 years with the Worthington organization, has rejoined the company as special sales



Coremaking Is an Important Feature of the Malleable Foundry

representative with headquarters in Buffalo. J. B. Allen, formerly president, Allen Engineering Co., Bridgeport, Conn., and also formerly with the Sperry Gyroscope Co., Brooklyn, N. Y., has been appointed special marine representative with headquarters in Harrison, N. J. H. G. Wood, formerly assistant manager, New England division, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has joined the Worthington company as electrical sales engineer. E. M. Paulin formerly connected with the General Electric Co., Schenectady, N. Y., in the New York office has been appointed electrical sales engineer.

John T. Clancy, E. W. Hammond, A. M. Boehm, Joseph F. Hecking, William J. Daly, G. A. Herrmann and W. R. Kennedy all connected with the Worthington company have been transferred to other positions. Mr. Clancy, formerly assistant manager, Buffalo works sales division, has been transferred from Buffalo to Harrison, N. J.; Mr. Hammond, formerly located in Buffalo, has been transferred to Los Angeles as special sales representative of diesel and gas engines sales on the Pacific coast; Mr. Boehm, also formerly at the Buffalo works, goes to Kansas City as diesel and gas engine specialist; Mr. Hecking formerly in the diesel and gas engines sales division, New York will hold the same position in the Buffalo division; Mr. Daly, assistant manager, Cincinnati works sales division, has been assigned to Pittsburgh on special sales work; Mr. Herrmann, formerly sales engineer at Chicago, has been appointed acting district manager, St. Paul, and Mr. Kennedy, sales engineer at Pittsburgh, has been appointed acting district manager, Kansas City.

Book Review

Chemistry of Engineering Materials, by Robert B. Leighou, cloth, 684 pages 5½ x 8 inches, published by McGraw-Hill Book Co., New York, and supplied by THE FOUNDRY, Cleveland, for $4.15, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House Westminster.

The second edition of this work appeared in 1925, and the present edition has been revised to include information on new developments which have taken place during the intervening six years. The first chapter deals with water for steam generation, the second with fuels and the third with refractory materials for furnace linings. Chapters IV and V are devoted to nonferrous metals and alloys with data on their method of manufacture, chemical and physical properties. Information also is given on the applications of the various alloys and metals for industrial use.

Chapter VI is on iron and steel with data on the various manufacturing processes for producing pig iron, cast iron, malleable cast iron, steel, and wrought iron. It is unfortunate that the author did not consult data of more recent origin than those mentioned in the portion relating to cast iron. By so doing, the author undoubtedly would have included mention of the low-carbon, high-test irons now being produced. Corrosion of iron and steel is the topic of chapter VII, and chapter VIII deals with sands.

Building stones, lime and gypsum products, and portland and other cements, and concrete are discussed in Chapters IX, X and XI. Chapters XII, XIII, and XIV relate to clay and clay products, paints, varnishes, stains and fillers, and lubricants. Glue, rubber and electrical insulating materials are described in the next three chapters while primary electric cells, secondary cells and hydrometry are the subjects of chapters XVIII, XIX, and XX.

Hold Golf Game

Detroit Foundrymen's association held its final golf game of the season at the Maple Lane Golf club, near Detroit. Fine weather added to the zest of the play and a fine time is reported. The first regular meeting of the association will be held Sept. 17 at the Ft. Shelby hotel.

The FOUNDRY Family Photograph Album

Upper Left

N. K. B. PATCH

Lumen Bearing Co., Buffalo

Upper Right

G. R. HANKS

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Lower Left

A. C. DENISON

Fulton Foundry & Machine Co., Cleveland

Lower Right

WALTER HARNISCHFEGER

Harnischfeger Corp., Milwaukee

TENTATIVE RECOMMENDED PRACTICE FOR

COPPER 80, TIN 10, LEAD 10 ALLOY

(*Continued from Data Sheet No. 876*)

MELTING

Experience shows that the elements other than copper, tin and lead have an effect on the melting of this alloy both as to melting point and the quality of the resulting casting. Additions of phosphorus, tin and lead must be made for the burnout, which is determined only by practice for each type of melting.

Pouring temperature varies indirectly with the amount of phosphorus present and the thickness of sections of the castings. To illustrate the relation of pouring temperature and phosphorus content, the data below are given:

Phosphorus Per Cent	Pouring Temperature	
Trace to 0.02	1900-2050° Fahr.	Phosphorus used as a deoxidizer.
0.10-0.20	1840-1900° Fahr.	Phosphorus used as a deoxidizer and part of alloy.
0.50-1.00	1500-1680° Fahr.	Phosphorus used as one of the metals in alloy.

IMPURITIES

Impurities or ingredients other than the copper, tin and lead, and their effects on this alloy, are as follows:

(a) *Zinc* is an impurity and increases grain size and shrinkage, and lowers the physical qualities, but does not make the alloy unfit for all purposes.

(b) *Phosphorus* is not an impurity but is used for two purposes, (1) as a deoxidizer, and (2) as one of the component parts of the alloy. As a deoxidizer it is used to reduce any ox-

(*Concluded on Data Sheet No. 878*)

TENTATIVE RECOMMENDED PRACTICE FOR

COPPER 80, TIN 10, LEAD 10 ALLOY

(*Concluded from Data Sheet No. 877*)

ides present to their metallic state. As an ingredient it increases the hardness, tensile strength and ductility, and decreases its shrinkage, cooling range and melting point. High phosphorus content also makes the alloy more difficult to handle in the foundry.

(c) *Sulphur* is an impurity but is sometimes used to hold lead in solution. It is generally conceded that it is better out than in, as it creates a gas that is hard to eliminate and also forms sulphides which increase the hardness.

(d) *Iron* is an impurity in this alloy and is found both in solution and in the free state. In both cases, it is detrimental to the alloy and should be kept as low as possible. It makes hard spots, increasing internal shrinkage and discolors the alloy.

(e) *Antimony* is an impurity. It alloys well with the rest of the mix and is very hard to get rid of, as it does not burn out very easily. It acts on the alloy very similarly to the action of zinc, giving increased grain size and affecting the physical qualities.

(f) *Aluminum* is an extremely dangerous impurity and even a few hundredths per cent is likely to ruin the alloy, making it unsound. Aluminum apparently alters the crystalline characteristics of the alloy markedly, even small amounts sometimes causing lead sweat.

(g) *Silicon* is an impurity that should be kept in the class with aluminum, as it does not help the alloy but shows signs of making trouble.

(h) *Nickel* is not an impurity but is added for its ability to hold the lead and to increase its density, which naturally increases its other physical qualities.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

BILL

By Pat Dwyer

Offers Advice on Cupola Operation

GLANCING idly through the mass of pages which go to make up one of the Sunday papers, my eye lighted upon a short item prefixed by the words: Alaska, Pt. Barrow. Before going any farther, perhaps I should throw out a first line of defence in the form of an explanation for the benefit of any purists who happen to be among us and who are ready with shining eyes, and equally shining teeth, to pounce upon that first sentence and ask me sarcastically if I have only one eye and if that eye is capable of hopping hither and yon like a tom-tit or a rubber ball on the end of an elastic string. You will pardon me dear reader for this temporary pause. You knew what I meant when I referred to the eye lighting and so forth. I knew what I meant, but in times like these with almost every person between six and 60 writing for publication, with literary sleuths nosing up every dark alley and with editors and publishers on every hand calling for more realism, one finds it advisable, nay, at times necessary, to explain that a colloquialism or a flight of fancy, is a colloquialism or a flight of fancy, simply that and nothing more.

By this time I imagine that even the most literal minded reader has decided that I probably am endowed with the usual number of eyes, movable to a certain extent on their own axes, but fixed in their relationship to the other component parts of the head piece. Also that both eyes were employed in the occupation of scanning the paper at the time and place hereinbefore mentioned. Just a moment —by referring to the first paragraph I note that I did not mention either the time or the place—well, that easily is remedied.

In fact the statement may be improved as well as remedied by the inclusion of a reference to the time, the place and a list of those present. Now I say that *those* in this instance is a personal pronoun and under no consideration to be hooked up with times and places. The hasty reader at this point may be tempted to jump to the conclusion that all this explanation is unnecessary.

"Why," he'll say to himself, mentally grinding his teeth the while "Why," he'll say, "the absent minded gommoch just said he was lampin' through the Sunday papers. If that statement does not definitely set the date as Sunday. I'll kiss a fat pink pig."

The guess is about as accurate as the usual guess, sometimes known

Hot News Right From Pt. Barrow, Alaska

under the more euphonious title *Business Prognostication.* Based merely on the statement that I was reading the Sunday paper, the reader is justified in assuming that the day was Sunday. However, the cautious reader will remember that the Sunday paper is issued early Saturday evening. He also will hark back in his own experience and remember Sunday papers that were anywhere from a day to a week old before they fell into his hands.

Too many business forecasts are based on single statements, on groups of unrelated statements, on sour messes of undigested statistics relating to wheat and steel and cotton, to the oil situation in the Southwest and the number of Mujiks to the square mile in Russia. Oracular opinions are expressed by heavy voiced gentlemen who could not tell you, if backed into a corner, whether wheat is a nut or a berry; whether steel is a product woven from steel wool in the steel mills or a metal that is lifted by huge buckets out of a blast furnace. Oil is just oil and when the gushers of the Southwest are mentioned they might just as well spout banana oil as petroleum. Owing to a subsidized Russian press, depreciated currency, the recent visit of George Bernard Shaw and—er—one thing and another, the speaker of the evening is not just sure whether the statement he intends to quote is: "So many Mujiks to the square mile," or, "so many miles to the square Mujik."

The foregoing calm and orderly presentation of a well known phenomenon will be skipped by the hasty reader—the very, identical person for whom it was intended—but will be welcomed by the cool, efficient, orderly person, the person who looks before he leaps, the fellow who investigates every problem thoroughly, who doubts every word he hears and whose nose ever is on the alert sniffing the tainted gale. Not one of the plain or ordinary, "I told you so," lads but one of the super type, the "I *could* have told you so," boys. In a word and to be brief the time was 8:10 or 8:15 p. m.—I would not start an argument over a 5-minute differential —8:10 or 8:15 on Saturday night. The place was the front porch of my humble cot and the only company I had was my old friend Bill, engaged for the moment in gleaning precious gems of information from the sporting pages touching on the activities of fighters, runners, ball players and others.

I was thinking of commenting on this interesting feature, more for the sake of inciting Bill to fly to the defence of these artists, than for any personal interest in the subject, when —as I mentioned some time back— my eye lighted on the little item from Pt. Barrow, Alaska. Ah, ha—this looked like more promising material.

Off hand I do not recollect the exact wording and unfortunately I neglected to clip the paragraph for future reference, but in a general way it dealt with a peculiar situation that recently has arisen in that famous land of ice and snow. One of the timid little eskimos in the vicinity committed a minor crime of some kind and promptly was arrested by the white authorities and thrown into the local jail. Here for a period of three months he was kept warm and comfortable and fed three times a day without having to lift a finger. The far northern version of the life of Reilly.

Naturally, the instant he was released he spread the good news among his friends and the result was a deliberate avalance of small crimes designed for the sole purpose of having the criminals arrested and thrown

into this most delectable of retreats, an establishment flowing—figuratively—with milk and honey.

Came a time, in the words of the inspired flicker writer, when the jail would hold no more. The epidemic of crime was continued for a short time so that the criminals might be listed on the preferred waiting list.

Free Board and Lodging Attract Man and Beast

"There y'are," I said to Bill after I had read the paragraph aloud for his benefit. "That seems to answer the ancient conundrum: 'Is an eskimo as dumb as he look, or, does he look as dumb as he is!'"

"Smart little fellahs, them eskimos," Bill agreed instantly, "They know a good thing when they see it and they know when they are well off. You never hear of one of those lads rambling away from home to live in a foreign country. He could roam the world round and never find a place like home. He works six months and he loafs six months and where can you find a fairer or even as fair a division as that?"

"Where do you find support for the statement that he loafs six months per year? While it is true that the sun does not appear above the horizon, the dazzling beams of the Aurora Borealis supply all the light he needs to carry on his hunting and fishing activities."

"That reminds me," said Bill, characteristically hopping from one subject to another "that reminds me of the time Red Donovan blew into Aurora, caught a job at the old C. B. & Q. foundry and then blew out again, just like the King of France and his twenty thousand men.

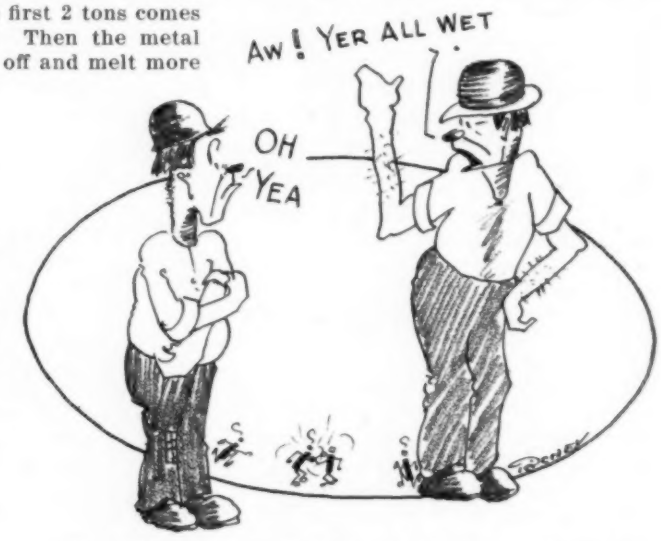
"For a short period previously Red had worked in a steel shop in St. Louis. This was many years ago when all steel molds were dried and the gaffer had to continually admonish the men-recruited from iron foundries—to pound the sand hard.

"Red's first job in Aurora was a grate bar filled with fragile green sand cores. The molds coughed and sputtered while he was pouring the metal into them and the castings when shaken out were found to be full of blowholes. The gaffer told Red he had rammed the sand too hard. "'Don't make me laugh' says brave Red. 'Hard? Whatd'ya mean hard? If hard rammin' is the proper caper in a big city like St. Louis, why isn't it good enough for a little burg like Aurora?' The point of course is open to discussion, but the gaffer cut the argument short by telling Red he was fired and that's a form of argument that admits of no discussion. I had a letter from a man the other day which shows that foundry problems still are turning up in large and small shops and that the millenium has not arrived yet despite all the experience we have gained over a period of many years.

"This man wrote me that he was puzzled by the erratic behaviour of his 48-inch cupola lined down to 37 inches, in which he melts a heat of 4 to 5 tons. The first 2 tons comes down sizzling hot. Then the metal commences to cool off and melt more slowly. About 1500 pounds of metal melted during this period is too cold to pour into light castings. After about 15 minutes the temperature rises again and the metal for the remainder of the heat is fit to pour anything. Charges are made up of 10 per cent steel scrap, 50 per cent machine cast pig iron and 40 per cent gray iron scrap. The sand bottom is 16 inches below the tuyeres and the coke bed extends to a point 36 inches above the tuyeres. A high grade by-product coke is used. At one time 900-pound iron charges were used with coke splits of 150 pounds. This was changed to 800-pound iron charges separated by 125-pound coke charges. Limestone to the extent of 20 pounds and 1 pound of fluorspar constitute the fluxing charge on each charge of iron and coke. The slag hole is opened about half an hour after the blast goes on, but the slag never runs freely. The cupola holds three charges when it is filled to the charging door. The coke is lighted with an oil torch at 11 a. m., and charging commences at 2:30 p. m. The blast is put on at 3:30 p. m., and the first iron runs over the spout 7 minutes later. This is one of many hundred, perhaps thousand cupolas without either pressure or volume gage and one into which the greater part of the charge is thrown by estimate rather than by actual weight.

"With so many possible sources of error, the only really satisfactory method of arriving at a plausible solution would be to visit the place in person and check up on the entire procedure from the time the bottom is made up until it is dropped. However, since this method automatically is ruled out the best that can be done is to indicate the possible causes for the peculiar behaviour of the cupola and trust to the inquirer to follow up the clues.

"Erratic behaviour of the cupola seems to indicate laxity or carelessness on the part of the cupola tender. This may be due to a natural gift or it may be due to lack of instruction and proper supervision. With every feature functioning properly and in orderly sequence the temperature of the iron should remain constant, within close limits, throughout the duration of the heat.



"You're Fired" Is a Hard Argument To Get Around

The extreme drop in temperature which characterizes the behavior of this particular cupola shows that the orderly sequence of operation is interrupted seriously at some point near the center of the program.

"At this distance and without any definite knowledge of many factors which might change the complexion of the situation, my first guess is

that the man on the charging platform throws the fourth charge of iron into the cupola without taking the usual and ordinary precaution of throwing a charge of coke under it.

"You might say no man of even ordinary intelligence could commit an error of that kind. That just goes to show how little you know of what men on the charging deck are capable. Mind you I am willing to grant that there are exceptions. I have known men on the charging deck who knew more than the foundry superintendent about the proper operation of a cupola, but then again, on the other hand, I have seen lads—willing workers and all that kind of thing—who required sharp supervision at all times.

"In this particular instance a possibility exists that some person in authority supervised the placing of the bed coke and the succeeding three charges of iron with splits of coke between the first and second and between the second and third. This left the third charge of iron flush with, or a little above, the charging door sill. In the ordinary course of events this would be covered with a split of coke before the fourth charge of iron was placed in the cupola. In this particular instance the three charges are allowed to stand for an hour and then the blast is put on. The entire charge immediately begins to sink and it is readily conceivable that the charging man should—as he thinks—follow instructions by immediately throwing the fourth charge of iron into the cupola.

"This double charge of iron effectually slows down the melting speed and reduces the temperature of the iron. Naturally the coke bed is almost exhausted before the over dose is melted. Succeeding generous splits of coke restore the bed to the proper height and raise the temperature of the iron for the remainder of the heat.

"Another possibility is that the bed is not as high as it is presumed to be. A person measuring the bed before it is lighted and finding it extending 36 inches above the tuyeres, probably will be surprised to find how it has dropped 3½ hours later when charging commences, or 4½ hours later when the blast is put on. Iron that has been soaking for an hour will melt hot, but by the time the first three charges of iron are melted, the bed has dropped below its effective height and the following charges of iron will melt slowly until comparatively heavy splits of coke have restored the bed to the proper height.

"Another thing I fail to understand is why he finds it necessary to light the cupola so far in advance of blowing time. With the tuyeres and tap hole open, the bed coke should burn through in less than an hour instead of—as stated—3½ hours, from 11 a. m., to 2:30 p. m. Also, while commenting on curious features, it is pertinent to point out that no need exists for slagging a cupola while running on a 1-hour heat. The amount of slag produced in that period is not sufficient to interfere with the operation of the cupola. Addition of 30 pounds of limestone to each charge after the fourth will insure a clean drop and a minimum amount of chipping and repair to the lining on the following day. I have advised him to plug the slag hole and pay no more attention to it.

"Instead of speculating further on the how and the why and the wherefor I sent him brief directions for the proper operation of the cupola. Also of course I pointed out that directions in themselves are of no use unless they are followed. Quite possibly he is familiar with the subject, but has overlooked the frailty of the human element. In that event this will serve as a reminder. If he is not thoroughly familiar with the subject of cupola operation, my comments will serve as a foundation on which to built, or a starting point from which to pursue further investigation.

"After the bottom doors are propped in place and the sand bed rammed down firmly, the bed coke is forked into the cupola until it extends to a point about 36 inches above the tuyeres. Apply the torch to the open breast at 1 p. m. With the tap hole and tuyeres all open the coke should be red all through at 2 p. m. By this time also the coke will have settled to a considerable extent. Coke is added to bring the bed up to the original level. The first charge, 800 pounds of iron, is placed on the bed. This is followed by 100 pounds of coke, 800 pounds iron, 100 pounds of coke and the third 800 pounds of iron. The cupola now is filled to the charging door. The tuyeres and blast pipe are closed to prevent the coke from burning away too rapidly. Conversely, if pressed for time, the tuyeres are left open until the time comes to put on the blast. Under ordinary conditions the iron is allowed to soak in the cupola for an hour before the fan or blower is started. This insures hot iron at the beginning of the heat.

"Almost immediately after starting the blower, the charge will commence to sink in the cupola. This is the signal to continue charging. The usual amount, 100 pounds of coke is placed on the third iron charge. The fourth charge of iron then is placed in the cupola and the sequence is repeated until the entire amount required for the day is in place.

"Many cupola men are agreed that 1000 pounds is the proper charge for a 37-inch cupola. Under certain conditions, short heats and castings which do not require the hottest iron, larger amounts are handled readily. However ,in the present instance I favor an 800-pound charge for a beginning with 100 pounds of coke between the charges. Later, with confidence increased and with a proper routine established, the weight of the iron charge may be increased, or the amount of coke may be decreased, to a certain extent. This point only can be established by an experienced person on the job, familiar with all the conditions."

Will Test Alloy Gray Irons

THE committee for improvement of cast iron through alloy additions of the Verein Deutscher Giessereifachleute has adopted a plan for investigating the effects of nickel and chromium upon the physical properties of gray iron. The types of iron to be tested may be produced in the cupola, oil furnace or electric furnace, with and without superheating, or with and without holding the iron at a given temperature for an extended period. The irons to be tested will be divided into two main groups based on carbon content. The first group will contain from 3.3 to 3.5 per cent carbon and the second, 2.9 to 3.1 per cent carbon. Each of the two main divisions is divided into two groups, one containing only nickel and the other chromium and nickel. Details of composition range are given in the accompanying table.

To carry out the various tests mentioned later, at least 10 specimen bars are to be poured from each charge. The bar dimensions are given as 1.18-inch in diameter and 29.57 inches long. The bars are to be cast on end in a dried mold which is gated at the bottom. The bars are molded without a parting line and fed from a common central sprue. Two of the bars are to be reserved and the other eight are used for the tests. In carrying out the transverse test attention should be paid to the observation of the relation between transverse strength and deflection. Measurements should be of the highest precision, but vernier readings will be satisfactory for general purposes. As many bars as possible should be tested.

The tensile test specimen is turned from a section of the transverse bar,

at least five tests being made. At least five specimens are to be used for the determination of compressive strength. The test pieces turned from the transverse bar are to be 0.98-inch in diameter and 2.76 inches long. Resistance to torsion or twisting moments is to be determined on at least five bars 0.71-inch in diameter and 7.87 inches long.

Shear strength is to be determined according to the method of Sipp and Rudeloff shown in Fig. 1. At least five tests should be made on specimens of the dimensions included in Fig. 1. Fatigue resistance or endurance limit of the irons is to be determined on a minimum of five specimens of the dimensions shown in Fig. 2. The specimens are to be tested in a Schenck type machine. At least five bars are to be used for determining the impact strength. The bar dimensions are given as 0.59-inch diameter and 6.3 inches long as shown in Fig. 3. The weight of the hammer to be used is 6.91 pounds which is dropped from a height of 1.18 inches. Brinell hardness is to be determined on at least eight disks 0.98-inch thick. Impressions are to be made on both flat sides of the disks with a 10 millimeter ball under a load of 3000 kilograms for 30 seconds.

Growth of the irons is to be determined on at least three bars 0.39-inch in diameter and 3.94 inches long containing small nickel or stainless steel buttons inserted in either end to provide more accurate measurements. The bars are heated to 1112 and 1652 degrees Fahr. and cooled alternately in such a way that the bars are heated, held 1 hour at the temperature and then cooled. Measurements are to be taken at the end of 25, 75, 200 and 500 of these cycles.

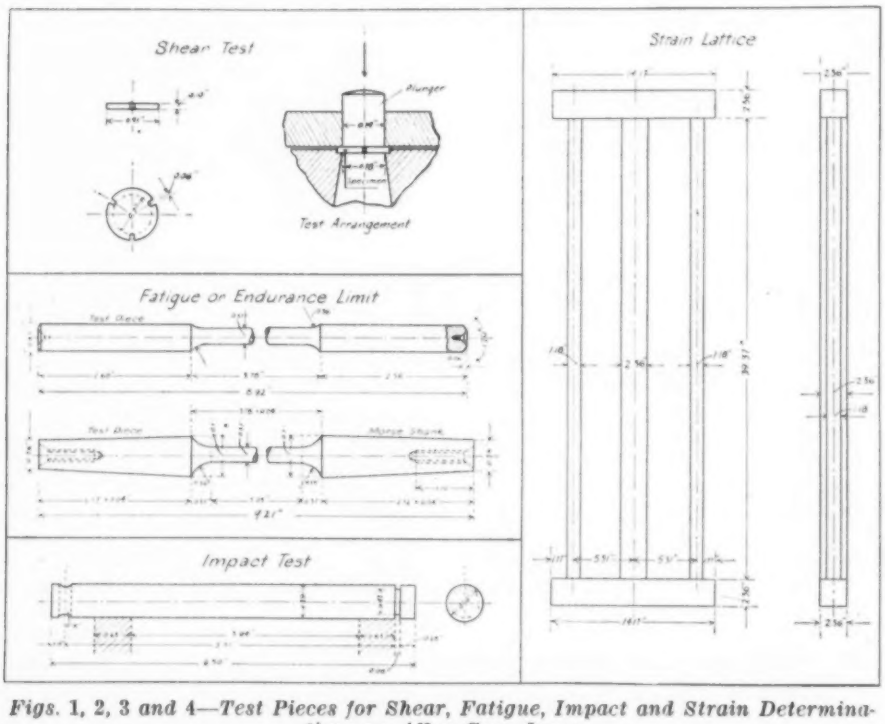
In addition to the various specimens mentioned which are turned from the transverse bars, three other test pieces will be used. These include the so-called K-test piece which is broken at the center to reveal shrinkage areas, a test piece known as the strain lattice shown in Fig. 4 which indicates the effect of casting strains, and a motor cylinder for the determination of machinability and wear resistance. Analyses of the various irons also is to be included.

Composition Ranges for Test Bars

Group	No.	Carbon	Silicon	Manganese	Nickel	Chromium
	(1)	3.3 to 3.5	2.3	0.6	0.0	0.0
		3.3 to 3.5	1.8	0.6	1.0	0.0
A		3.3 to 3.5	1.3	0.6	2.0	0.0
	(2)	3.3 to 3.5	2.3	0.6	0.0	0.3
		3.3 to 3.5	1.8	0.6	1.0	0.3
		3.3 to 3.5	1.3	0.6	2.0	0.3
	(1)	2.9 to 3.1	2.3	0.6	0.0	0.0
		2.9 to 3.1	1.8	0.6	1.0	0.0
B		2.9 to 3.1	1.3	0.6	2.0	0.0
	(2)	2.9 to 3.1	2.3	0.6	0.0	0.3
		2.9 to 3.1	1.8	0.6	1.0	0.3
		2.9 to 3.1	1.3	0.6	2.0	0.3

Form New Company

Robert Earl Jr., Frazer M. Moffat Jr., and Leander H. Conklin, have formed Earl, Moffat & Co. Inc., to manufacture and merchandise foundry core oils and bonding materials, developed and marketed by the Earl Paint Corp., Utica, N. Y. The new company will maintain offices at 420 Lexington avenue, New York, and 258 Genesee street, Utica, N. Y. Branch offices and manufacturing plants will be operated at Detroit and Baltimore.



Figs. 1, 2, 3 and 4—Test Pieces for Shear, Fatigue, Impact and Strain Determinations on Alloy Gray Irons

Woman Manages Shop

Out of approximately 6000 foundries in the United States and Canada, it is probable that the number operated by women, that is by women in supreme authority, can be counted on the fingers of one hand. Also, so far as our records show, in each one of the isolated instances the woman has taken charge upon the death of her husband, father or other close relative formerly in command of operations.

The latest instance of this kind is that of Ethel B. Higgins, President, J. C. Higgins Mfg. Co., San Diego, Calif., and widow of the late John C. Higgins who established the business in 1915 and operated it continuously until his death a few months ago.

The late Mr. Higgins commenced his foundry career at the age of nine in the core room of the Atlas Engine Works, Indianapolis, Ind. He was so little he had to stand on an empty box to enable him to work at the bench. After considerable experience in charge of foundries and as molding machine expert he went to the West Coast in 1900 where he established the Standard Brass Castings Co., in San Francisco. The plant was destroyed in the earthquake and fire of 1906, but he rebuilt it and continued to operate it for several years, when he sold his interest and retired. In 1915 he started again on a smaller scale in San Diego.

Gives Metal Prices

According to *Daily Metal Trade*, Cleveland, the average New York prices for nonferrous metals during August were as follows: Casting copper, 7.287c; electrolytic copper, 7.529c; Straits tin, 25.747c; lead, 4.4c; antimony, 6.61c; aluminum, 98.99, 22.90c. Zinc averaged 3.818c, East St. Louis, Ill.

Overloading Reduces Efficiency In Sandblast Barrel Machines

Capacity of Barrel, Angle of Blast, Speed of Barrel and Type of Work Are Other Factors Affecting Production

By Louis D. Peik

RESULTS for recent series on tests on sandblast barrel machines indicated that the following five general causes influence cleaning production: Depth of loading; capacity of barrel; angle of blast; speed of barrel; mixture and class of work. Naturally, design of barrel also influences production of cleaning castings.

Penetration of Blast

A shallow load is much more affected by penetration of blast than a deep load, and consequently the abrasive covers more surface. It is also true that shallow loads agitate more during the rotation of the barrel and tend to turn over all of the pieces. A shallow load is considered one in which the material, when at rest, lies below the center line of the rotating heads. Each piece, when starting at the bottom of the cataract, follows a definite cycle and breaks at the crest, as illustrated in Fig. 1. Fig. 2 represents an overloaded barrel which indicates how pieces in the center zone recycle below the blast nozzles.

The load capacity of the barrel is an important one from the standpoint of production. Therefore it is necessary that the barrel always be loaded to approximately one-half full, as in Fig. 1, unless the work happens to be of a exceedingly open and frail construction, such as lighting equipment, differential housings, and the like, in which case the cycle zone is much less defined, making it posisble to blast a larger load in the barrel for effective blasting. There will be no saving in charging smaller loads, because the handling time offsets the small gain in cleaning time.

The angle of blast is approximately 45 degrees but pieces being cataracted present their surfaces to the blast nozzles at varying angles. Therefore, the method of making the blast most effective, is to strike the work at the mean crest at a position between the lower and the upper crest where the work begins to cataract. If the lowest crest is considerably above the center of the barrel, due to the large sized pieces, the nozzles should point well upward. Pieces that are somewhat small, for example measuring between 2 and 4 inches in diameter, cataract from the crest closer to the center of the barrel and, therefore, the nozzle should be set closer to the center.

The speed of the barrel should vary with the size of pieces to be cleaned. A fast turning barrel will tend to increase the agitation of pieces, making the cataract faster and passing the work through the blast at a high rate of speed. The higher speeds have indicated a loss in efficiency due to the blast passing too fast over the work surface. Abrasion on a fast moving surface is appreciably less effective than on one moving slowly.

Small pieces subject their sides more often to the blast in the movement to the bottom of the cataract and, therefore, permit a somewhat greater speed of the barrel; but larger pieces have the tendency to slide and when rolling, turn over a less number of times, thus escaping much of the blast. Therefore it is evident that a greater speed can be obtained with small pieces than with larger sections.

Circumferential Speed

Numerous experiments have indicated that 24 feet per minute circumferential speed is best for small work, pieces measuring about 2½ inches cross section; 20 feet circumferential speed for pieces measuring 4 to 6 inches cross section; and 17 feet per minute for pieces measuring 8 to 12 inches.

As shown in Fig. 3, a high speed barrel advances the crest considerably higher as indicated previously. This

(*Concluded no Page* 55)

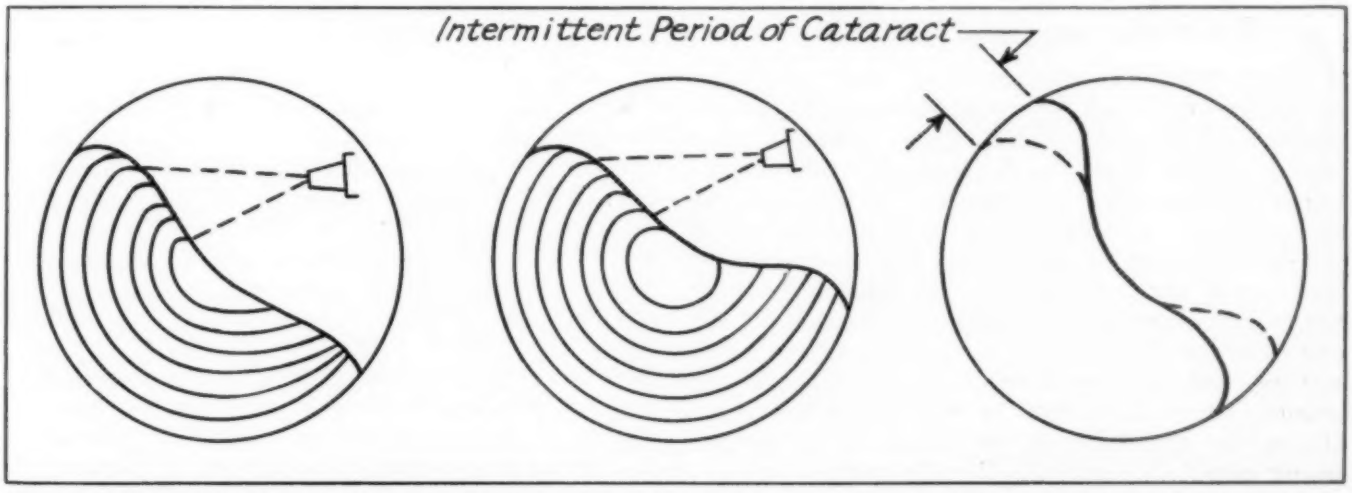


Fig. 1 *(Left)—With Ideal Loading, Each Piece Follows a Definite Cycle and Breaks at the Top.* *Fig.* 2 *(Center)—In the Overloaded Barrel, the Pieces Recycle Below the Blast Nozzles.* *Fig.* 3 *(Right)—A High Speed Barrel Carries the Material Higher*

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ Do You Owe Your Customer?

PROBABLY many foundrymen in these stormy days find collections slow. Even good customers of many years' standing are a bit lax in meeting their statements. Some probably are in genuine need of time extensions and reasonable forebearance may build good will of future value. Others, cloaking their convenience in terms of necessity, are withholding payments which could be met. Few are rushing forward to square their accounts and none are delivering checks in advance to cover work that is not yet in the sand. These unpaid accounts, large in many cases, represent borrowed capital and a strain on the foundry which will not be fully compensated when all bills are paid in full.

HOW much does the foundry, any foundry, owe to its customers? During these times, the firm which is progressive is making changes. Close attention to details of cost, short cuts in operations, installation of equipment purchased on the sole promise of economies of manufacture, are the order of the day. Is the saving accomplished by these means—all factors of good management or manufacturing practice—due and payable to the customer? Probably the immediate answer to the question thus stated is —NO—the saving belongs to the foundry with sufficient ability to accomplish these economies. Why, then pass along all the saving to the customer? No foundry owes its customers, nor any one customer the entire amount which can be made by saving economies.

¶ Moratorium on Morticians

A CASTINGS manufacturer had occasions to call on one of his large customers—that is the customer had been an important buyer in past times, but his orders had dropped both in number and quantities. So instead of sending the salesman who had cultivated the buyer for many years, the foundryman made the call himself. He found the customer, a machine manufacturer, in murky gloom, willing to broadcast every piece of ill news of a business or personal nature that had come within his ken for many moons. More than that he wanted to peer into the future and forecast ruin and desolation for many months to come.

THE foundryman was a sympathetic soul, but he came to sell castings and not to hold a lodge of sorrow. So he cited instances of improvement that he had known or heard about in the immediate past. He told of the improved condition induced in one instance by a sizeable order of tractors for road improvement in the state. The purchase of several large lots of grinding and milling machines to modernize the transmission gear mechanism of two leading models of a group of automobile manufacturers was another light rift in the clouds. Before he left, the customer had changed his tone, lighted a fresh cigar and decided to retain a salesman whose job was trembling in the balance. Perhaps there might be some business, sometime, somewhere if someone could be found who thought it worth while to go after the order.

¶ Study Your Own Product

THE business recession of the past two years has been attributed to many causes and much space has been devoted to the ills that it has created. However, it has served several useful purposes that often are overlooked by the business executive. In the first place, it has forced manufacturers to study costs more closely and to increase the efficiency of their plants. They have been driven rather than led, by the extremely close competition for business. In the second place, because of the competition, many companies have suspended operations. That factor has a tendency to stabilize business by eliminating those who do not and will not understand costs and sound business practices. This cleansing process has been under way for some time and is continuing with some abatement.

ANOTHER effect of the present strenuous times, has been to force the business man to study closely the application of his product and to seek fields where his product will give highly efficient service where it has never been used previously. That the foundry industry is not backward in its search for new uses, is evidenced by the use of castings for crankshafts in certain types of engines. A steel foundry has shown that the cast crankshaft is in many ways superior to the forged variety. This is but one example of the research that is being conducted to find where castings may render a more satisfactory service than other types of fabricated materials. Research of this type will increase the scope of the foundry industry.

Personal

Albert E. Harrison, general superintendent of foundries and pattern shops, and **J. M. J. Keogh,** assistant to the general works manager, Allis-Chalmers Mfg. Co., Milwaukee, were tendered a banquet by the A-C Fifty Year club recently in honor of the completition by each of 50 years of service with the company. Mr. Harrison entered the employ of the old E. P. Allis & Co., forerunner of the present company, on Feb. 28, 1881, and Mr. Keogh on Aug. 8, 1881. Mr. Harrison has the longest service record of any employe of the company. Both men are still active.

Herb L. Wharton, formerly connected with the Shilling Foundry & Machine Co., Columbus, O., has been made general superintendent, Marathon Foundry & Machine Co., Wausau, Wis.

Etienne Magdelenat Jr., son of **H. Magdelenat,** vice president of the Association Technique de Fonderie de Paris, and identified with Usines de Rosieres, Bourges, France, sailed for France Sept. 4, following a short visit to this country. Etienne Magdelenat is a student at the Ecole Centrale des Arts et Manufactures of Paris.

Herman H. Brien, formerly associated with the Belle City Malleable Iron Co., Racine, Wis., and the Dayton Malleable Co., Dayton, O., has left for Russia, where he will be superintendent of the malleable iron division of the Kharkov tractor plant in the Ukraine. **T. G. Stewart** formerly foundry superintendent, J. I. Case Co., Racine, also has sailed for Russia to become superintendent of the entire Kharkov works.

Francis Bradley, formerly general superintendent, Midvale Co., Nicetown, Pa., has been elected vice president in charge of operations to succeed **Dr. Harry L. Frevert,** who has been elected president to succeed the late Alva C. Dinkey. Mr. Bradley was graduated as a mechanical engineer from Massachusetts Institute of Technology. He succeeded Dr. Frevert as general superintendent of Midvale in 1923 and has held that position until his recent election to the vice presidency.

Overloading Reduces Blast Efficiency

(*Concluded from Page* 53)

over-burden at the top results in almost direct drop of the work to the bottom. There is also a tendency for a uniform flow, not desirable as some recent experiments have proven. Barrels rotating at the slower speeds produce an intermittent crest break which apparently increases production because when the work is at rest for just a moment the blast is much more effective. This intermittent crest is caused by the work being raised slowly to an overburdened position then falling to the bottom, due to the natural angle of repose. This is immediately followed by a second break of the over-burdened position. The intermission of the cataract break is about ¾ of a second in a 36 inch diameter barrel.

Mixing small pieces with large has some advantage in causing large pieces to turn over oftener and thus aiding in cleaning time. The action tends to push the work out of recycle paths, which is desirable in machines having stationary nozzles. This feature is not important, of course, when nozzles travel or oscillate with the barrel axis. Frail and light work should never be loaded with heavy round pieces as it is obvious that the heavy pieces will seek the bottom of the load faster than the light, thus causing breakage.

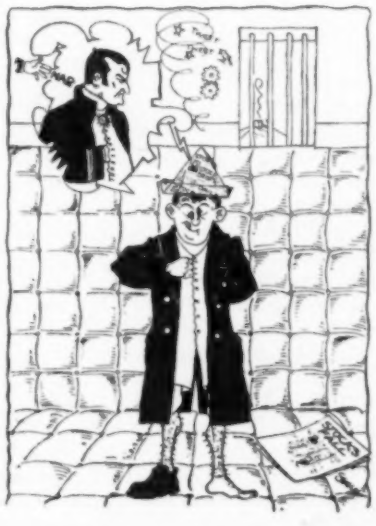
Steel Founders Report

According to the Steel Founders Society of America, 47.6 per cent of the membership reporting consider the business outlook as fair, 50.8 per cent as poor and 1.6 per cent as good. Operations in July were below 50 per cent in 90.4 per cent of the plants reporting.

Buys Separator Firm

Leavitt Machine Co., Orange, Mass., has purchased the separator business from the Swendeman Corp., Boston, and will manufacture and sell the Swendeman separators and drains for compressed air lines. Mr. Swendeman has become associated with the Leavitt company.

Faked Foundry Facts



Bottom Dropped

Gray Iron Institute Plans Meeting

Problems of the industry will be discussed at a series of special sessions which will feature the fourth annual convention of the Gray Iron institute at West Baden Springs hotel West Baden Springs, Indiana, Oct. 15 and 16. George L. Willman, Chicago, an authority on merchandising, will discuss new sales methods and give suggestions for merchandising gray iron castings. Willman has assisted a number of industries in expanding markets and developing new fields for products.

"Rate Setting" is one of the subjects for a round table discussion at the cost session with William J. Grede, Liberty Foundry, Inc., Wauwatosa, Wis., chairman. "The Foundry Budget" and other subjects of a similar nature also will be included in the cost program. Important topics scheduled for the technical session include "Standard Practices and What They Mean to the Industry," "Gray Iron Castings of Modern Design" and "Proper Specifications or Interpretations of the Technical Bulletins." A special surprise feature is being arranged, and, in addition, there will be a program for the ladies, a golf tournament on Friday afternoon and the annual banquet with one of the country's important business executive as the speaker.

Chairmen of the special committees arranging the various convention activities are as follows: Golf, Don McDaniel, Decature Casting Co., Decatur, Ind.; ladies program, Mrs. B. H. Johnson, Philadelphia; nominating, George W. Morrow, Goslin-Birmingham Mfg. Co., Birmingham; resolutions, J. K. Raithel, John C. Kupferle Foundry Co., St. Louis; attendance, A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; and reception, Charles C. Erhart, Chris Erhart Foundry, Cincinnati.

Castings Are Required

About 1500 tons of gray iron and steel castings will be required in the construction of the Chicago post office and federal building. The general contract, the contract for the structural steel, and several subcontracts have been let. American Bridge Co. has the contract for the structural steel, totaling 48,200 tons.

C. W. Traughber has been appointed technical and metallurgical advisor of the National Blower Co., Cleveland. Mr. Traughber formerly has been associated with the Anaconda Copper Co., New York; American Smelting & Refining Co., and other smelting plants for many years. He has had considerable experience in fume and dust problems.

Completes Organization of Flask Company

Following a number of years' experimental work in the plant of the Fort Pitt Steel Casting Co., McKeesport, Pa., and a number of other foundries making a wide variety of work, the Fort Pitt Flask Equipment Co. was organized as noted in THE FOUNDRY, July 15, to engineer foundry flasks. Offices have been established in the Oliver building, Pittsburgh, with C. H. Curry, president; H. J. Koch, vice president; C. S. Koch, treasurer, and C. W. Miller, engineer.

In addition to selling flasks manufactured by the Fort Pitt Steel Casting Co., the sales plan contemplates a working arrangement with established and recognized steel foundries in localities where the time element and transportation considerations will serve to promote this arrangement. The company plans to work with foundry engineers, molding machine manufacturers and handling equipment builders in meeting individual requirements not only in steel but in other types of flasks.

The development and sales work of the Fort Pitt Flask Equipment Co. will be furthered by J. C. Peirce, sales engineer, formerly identified with various organizations including Farrell Foundry & Machine Co., Ansonia, Conn.; Maxwell Chalmers Automobile Co., Detroit; Saginaw Foundry division, General Motors Corp., Saginaw, Mich., and National Sanitary Mfg. Co., Salem, O. Mr. Peirce later was identified with the pressed steel department of Truscon Steel Co., Youngstown, O., specializing in flasks.

W. R. Beck also will be identified with sales and engineering work. He is a graduate of Case School of Applied Science, Cleveland. Following a connection with Arthur G. McKee Co., Cleveland, on blast furnace construction, he became chief engineer of the Hill Clutch Co., Cleveland, and later was chief tool designer of the Pressed Steel Co., Detroit. Mr. Beck organized a gray iron foundry in Detroit and served as president and general manager until 1919, following which he was manager of sales for the Massillon Steel Casting Co., Massillon, O. Both Mr. Peirce and Mr. Beck have worked for a number of years on development work for the Fort Pitt Flask Equipment Co.

Leo B. Callahan, who for a number of years was connected with the Nugent Steel Castings Co., Chicago, and the Sivyer Steel Castings Co. which took over the Nugent foundry, will be a sales engineer for the flask company. Mr. Callahan left the Sivyer firm in January, 1931, to affiliate with the West Michigan Steel Foundry Co., Muskegon, Mich., where he remained until August, 1931.

In addition to these men, whose services are devoted exclusively to the Flask Equipment Co., the Fort Pitt Steel Casting organization is making available the services of Thomas F. Dorsey, assistant manager on sales and engineering; W. J. Corbett, for many years secretary and manager of the Steel Founders' Society; Morley B. Elwood, pattern foreman; Vincent Clein, assistant in design; David F. Geissinger, consulting expert on machining; and Peter Worthy Jr., superintendent in charge of flask production.

H. J. KOCH was born in Buffalo and attended the public schools in that city until the death of his father when Mr. Koch was 15, resulted in his being left to manage a shoe manufacturing company and two retail stores. He attended commercial college to master those principles which would enable him to handle that business and after the sale of those establishments was connected with R. G. Dun & Co., in Buffalo, on credit investigational work. Later he was employed by a saddlery hardware company until 1897 when he became directing secretary on membership work for the Buffalo chamber of commerce.

Mr. Koch's entry into the steel castings business in 1904 was marked by his appointment to special fact finding and advisory work on administrative matters to the Sharon plant of the American Steel Foundries and later he was assistant to the district manager of this organization at Alliance. In 1905 he became assistant general manager in charge of the commercial end of the business for the General Steel Casting Co., Verona, Pa., and was interested in the establishment of the Fort Pitt Steel Casting Co. which was organized in 1906, although he did not become actively connected with that firm until 1908. He was successively secretary, sales manager and vice president of the Fort Pitt Steel Casting Co. which latter position he still retains.

In addition to his active business life Mr. Koch has been identified with various national, commercial and technical organizations including the American Foundrymen's association, the National Founders' association, the Steel Founders' Society of America and the Foundry Equipment Manufacturers' association.

C. W. MILLER was apprenticed to the Coshocton Iron Co., Coshocton, O., after finishing school, removing to Monongahela City, Pa., when that company established a plant there. Later he returned to the Coshocton plant where he was in charge of the foundry, and later was identified with the Black Diamond Engineering Co., Black Diamond, Pa. He returned to the Coshocton Iron Co. as superintendent again and remained until 1913 when he was made assistant superintendent for the General Electric Co. during and until the close of the war. He then was employed as foundry service engineer for the Herman Pneumatic Machine Co., Pittsburgh, and later was a foundry engineer on independent consulting practice.

C. S. KOCH was graduated from the Mass chusetts Institute of Technology in 1898 and after a brief connection with that institution as instructor in metallurgy entered the foundry business with Wm. Sellers & Co., Philadelphia, where he later became superintendent. His other foundry connections include assistant manager at the Titusville plant of the American Radiator Co., manager of the Franklin plant, American Steel Foundries and manager of the Sharon works of the same company until 1906 when he became president and general manager of the Fort Pitt Steel Casting Co. During the war, Mr. Koch was employed as a civilian in charge of all matters pertaining to steel castings supplied the ordnance department of the United States army. He is a member of the American Iron and Steel institute, the American Society for Testing Materials, American Institute of Mining and Metallurgical Engineers, the National Founders' association and a past president and past director of the American Foundrymen's association.

OBITUARY

Harold A. Lindahl, age 34, vice president, Henry Lindahl Foundry & Machine Co., Chicago, died Aug. 31. Mr. Lindahl had been secretary of the company until the death of his father, Henry Lindahl, about a year ago, when he became vice president, and his brother, Fred H. Lindahl, became president. He was a native of Chicago and had attended Lewis institute, Chicago. He had spent all of his business years with the company his father founded about 35 years ago. He was a member of the Swedish Engineering society and a number of other organizations.

Abram Gross, secretary-treasurer, Spring City Foundry Co., Spring City, Pa., died Aug. 19, at Atlantic City, N. J.

John F. Garrett, foundry manager, Armstrong Mfg. Co., Springfield, O., died recently in that city. He was 42 years old.

Paul F. Schryer, general superintendent of tractor factories, International Harvester Co., with headquarters at Milwaukee, died recently. He was 59 years of age.

Charles W. Smith, 72 years old, founder of the Smith Elevator Co., Warsaw, N. Y., and its principal executive for many years, died Aug. 24 at his home in Orchard Park, a Buffalo suburb. Mr. Smith retired from active business several years ago.

Conrad Braun, age 85, one of the founders and a former president of the Butler Street Foundry & Iron Co., Chicago, died recently. Mr. Braun retired from the presidency of that company about 15 years ago. He was a native of Germany and went to Chicago in 1867.

Charles H. Evered, Evered Foundry & Machine Works, Superior, Wis., which he founded in 1900, died recently at Superior at the age of 70 years. Born in Detroit, he was employed as mechanic in the old Wyandotte, Mich., shipyard and later became superintendent of the water works.

Daniel A. Lucas, vice president, Prime Mfg. Co., Milwaukee, died recently after an illness of two weeks. He was a railroad man for 35 years before joining the Prime company in 1918. While with the Chicago, Burlington & Quincy shops at Havelock, Nebr., Mr. Lucas was elected mayor and served several years. He was born in Green Bay, Wis., in 1866.

Charles A. Fickes, formerly foundry superintendent, Detroit Malleable & Brass Works, Wyandotte, Mich., died recently in Canton, O. Mr. Fickes was born in Wooster, O., Oct. 17, 1870, and began his foundry career with the McClain Co., Canton. He remained with that firm for 27 years and for 12 years was in charge of the foundry. During 1917 and 1918 he served as night superintendent, Timken Detroit Axle Co., Canton. In 1925, he went to Wyandotte, Mich., as foundry superintendent, Detroit Malleable & Brass Works where he remained until May 4, 1931, when he was forced to resign because of ill health.

Herman O. Lange, age 76, president, Ferguson & Lange Foundry Co., Chicago, one of the oldest foundrymen in the Chicago area, died Aug. 25. Mr. Lange, with the late William Ferguson, organized the business in 1896 and the former purchased Mr. Ferguson's interests in 1915. A native of Brumberg, Germany, Mr. Lange went to Muskegon, Mich., as a youth, where he was engaged in

Herman O. Lange

the lumber business. Later he went to Chicago and entered the foundry business. Mr. Lange long has been active in establishing better cost studies in foundries. He held membership in the American Society of Metallurgical Engineers, American Foundrymen's association, Gray Iron institute, the Chicago Foundrymen's association, and various other organizations.

Alfred H. Mulliken, 77 years old, pioneer railway supply manufacturer and for more than 30 years president, Pettibone-Mulliken Co., Chicago, steel and gray iron castings and railway supplies, died Sept. 2, at his home in New Canaan, Conn., where he moved 3 years ago, after disposing of his interests in Chicago. A descendant of Samuel Mulliken, who emigrated from Paisley, Scotland, to Salem, Mass., he went to Chicago when he was 15 years old and started as a shipping clerk for Crerar, Adams & Co., railway supplies. He declined a partnership in the firm later, and in 1880 with Asa G. Pettibone, who died 25 years ago, established the Pettibone-Mulliken Co. In 1885 the company sold its jobbing business to Crerar, Adams & Co., and became exclusively manufacturers of railway equipment. When the Pettibone-Mulliken Co. was incorporated a few years later, Mr. Mulliken was secretary-treasurer, later becoming president. In 1899 he purchased the business of his associates. He retained the presidency until 1928, when he disposed of his Chicago holdings.

Ohio Group Announces Safety Campaign

A statewide safety campaign involving nearly 600 foundries, will be started Oct. 1 by the Ohio Foundries association, Cleveland, in an effort to secure a lower industrial insurance rate. Plans for the campaign were outlined shortly after the Ohio industrial commission reported a deficit of $706,796 in four of the foundry classifications, and increased the rates on two of the groups.

For the ensuing year, the Ohio state insurance rates for iron foundries will be increased 25 per cent from $1.20 to $1.50 and the rate for bronze and aluminum foundries will be increased 33 1/3 per cent from 90 cents to $1.20 for each $100 payroll. No increases were made in the steel casting rate of 60 cents or the malleable iron rate of 70 cents. According to the state report, the deficit in the iron foundry classification is $376,889; steel casting $184,640; brass, bronze and aluminum foundry, $98,915 and malleable iron $46,352. The alloy metal castings classification shows a surplus of $5229. Four reasons are advanced for the large deficits, including increased benefits for injured employes under recent state legislation; decreased payroll; larger number of claims being filed, and a larger number of accidents based on time worked.

A. H. Kramer, Advance Foundry Co., Dayton, O., is general chairman of the campaign and J. W. Beall, insurance commissioner, Ohio Steel Foundry, Lima, O., is assistant general chairman, according to Robert Hoierman, secretary, Ohio Foundries association. The state has been divided into six districts. Don McDaniel, Hamilton Foundry & Machine Co., Hamilton, is chairman of the Miami Valley district; J. W. Beall, Ohio Steel Foundry, Lima, the western Ohio district; Fred Bennett, Buckeye Steel Casting Co., Columbus, central Ohio district; L. P. Henry, Maumee Malleable Casting Co., Toledo, the northwest Ohio district; Ralph West, West Steel Casting Co., Cleveland, the northeast Ohio district and J. L. Wick Jr., Falcon Bronze Co., Youngstown, the eastern Ohio district. The campaign will continue for six months.

William F. James, formerly Middle Atlantic district manager, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed assistant to the commercial vice president, Atlantic division of the company.

What Others Are Thinking

Abstracts Selected from European Foundry Literature

Iron Must Be Melted Hot

Chilled iron and Pseudo-chilled Iron (Hartguss und Pseudohartguss), by Hugo Patsch, *Die Giesserei*, Dusseldorf, Germany, March 13, 1931.

Chilled castings made properly contain three zones of varying structure. The first is the exterior hard, white zone which merges into a mottled section, partly white and partly gray iron, and the third zone which is all gray. There should be no sharp demarcation between any of the zones. However, if the iron is not charged and melted properly an iron is obtained in which the white zone is adjacent to the gray zone. Such iron is much harder than the chilled iron properly made, and the structure is coarser. Therefore, it is necessary that all the factors of composition, hot melting to insure solution of all the carbon, and pouring temperature be considered in making good chilled castings.

Must Melt Bronze Rapidly

The Melting of Dense Bronze for High Pressure Demands (Das Erschmelzen von dichter Bronze fuer Hochdruckbeanspruchung), by M. Schied, *Die Giesserei*, Duesseldorf, Germany, July 24, 1931.

Every foundryman knows the difficulties encountered in producing nonferrous castings for pressure work, and that as the pressure increases, the difficulties of obtaining sound castings increase. For pressures of over 100 atmospheres (1470 pounds) the author recommends an alloy of 83 per cent copper; 6.5 per cent tin; 8.5 per cent zinc, and 1 per cent nickel with the addition of 1 per cent of the charge weight of 10 per cent phosphor-copper. The nickel is said to give an especially fine structural formation.

The raw materials should be selected carefully to obtain the best results. Electrolytic copper is the first choice, but clean copper sheet clippings, or pieces of pure copper tubing may be used. It must be ascertained that the raw material does not contain copper coated iron. If copper fireboxes are used, bolts and rivets must be removed as they are alloyed with 6 per cent manganese.

The raw materials in the crucible should be protected against gases during melting and broken glass is suitable for the purpose although others may be used; the latter resulting from experiments of the founder. The cover should melt at a low temperature, and be fluid enough to spread over the surface of the molten metal to protect it from furnace gases. Additions of tin and zinc should be made from 5 to 10 minutes at the most before the metal is poured.

An outline of melting is given as follows: The copper and nickel are placed in the crucible and melted as rapidly as possible. As soon as the copper is melted, three-fourths of the phosphor-copper is added. Then the tin, previously heated to a good temperature is added. Now the heated zinc in pieces is stirred in. Then the metal is raised quickly to the pouring temperature and the crucible drawn from the furnace. The metal is skimmed and the remainder of the phosphor-copper added to make the metal fluid.

High Temperature Properties

Alloys for Use at High Temperatures, Effect of Composition and Exposure to High Temperatures, by C. H. M. Jenkins and H. J. Tapsell, *Foundry Trade Journal*, July 16, 1931.

This paper is a continuation of the study of nickel-chromium and complex iron-nickel-chromium alloys.

Fifteen alloys of different compositions were prepared with the carbon ranging from 0 to 2 per cent and silicon from 0 to 1.5 per cent. Eight of those alloys were selected for exposure tests at 1472 degrees Fahr. and five of the eight alloys with characteristic properties were used for further tests by exposure at temperatures between 1112 and 2030 degrees Fahr. for a uniform period of 4 days.

Tensile tests of the various alloys at room temperature show that additions of silicon do not bring about any marked change in the properties while additions of 0.5 per cent carbon cause a slight hardening and 1.0 per cent produces an improvement in strength. Alloys which exhibit the greatest strength contain 1.5 per cent carbon but the addition of 2 per cent causes the properties to fall off considerably. In tests at 1472 degrees Fahr. of short time duration, the alloys containing 0.5 per cent carbon show greater increase in strength over the carbonless alloys than atmospheric temperature tests indicate while two alloys containing 1.5 per cent carbon at that temperature show a tensile strength of over 30 tons per square inch. Alloys with carbon contents on either side of that amount indicate strengths of less than 25 tons per square inch.

Carbonless alloys tested at atmospheric temperatures showed from 18 to 28 per cent elongation in the chill-cast state but alloys with 0.5 per cent carbon do not extend more than 3 per cent. At 1472 degrees Fahr. the carbonless alloys show less than half the ductility at room temperature while that property in carbon-bearing alloys increased sometimes to three times the atmospheric amount.

Additions of silicon do not affect greatly the strength of the alloys in the prolonged stress tests but 1.5 per cent carbon improves the stability of the alloys. Maximum resistance to stress is obtained in an alloy containing 1.5 per cent carbon and 1.0 per cent silicon. Microexamination showed that silicon is retained in solid solution and the presence of that element in the absence of carbon does not improve the strength under either prolonged or short-time tests. Carbon has three effects on the alloy, namely, it produces a eutectic, the proportions of which affect the casting properties of the alloy favorably; it increased the strength of the alloys under prolonged stress; and it forms a complex carbide which increases resistance to prolonged stress at a critical composition of 1.5 per cent. Silicon improves the carbon-bearing alloys slightly and increases the fluidity.

Melting point of an alloy containing 1.5 per cent carbon, 1 per cent silicon, 30 per cent chromium, 4 per cent tungsten, 30 per cent nickel and the remainder iron melts at 2345 to 2397 degrees Fahr.

Graphite Precipitates Directly

Graphite Formation in Cast Iron (Ueber die Graphitbildung im Gusseisen), by Heinrich Hanemann, *Stahl und Eisen*, Duesseldorf, Germany, July 30, 1931.

Some difference of opinion exists as to whether graphite is precipitated directly from molten gray iron on freezing or whether it results as a disintegration product from cementite or ledeburite. Hanemann investigated the problem using an iron containing 4.15 per cent carbon, 0.09 per cent silicon, 0.18 per cent manganese, 0.024 per cent phosphorus, and 0.019 per cent sulphur. With ordinary cooling the solid material had a white fracture, but by cooling at the rate of 2 degrees per minute in the crucible, a gray fracture was obtained.

The eutectic transition point of the alloy occurred at 1141 degrees Cent. (2085.8 degrees Fahr.) and lasted for 52 seconds at 2 degrees per minute cooling speed with a 15 gram melt. Tests were conducted by chilling specimens above, at and below the transition point and examining the structures microscopically. Those chilled above the transition point showed a pure ledeburite structure. At the beginning of the transition point, chilled specimens showed graphite next to the ledeburite, the percentage of gray structure increasing with the time of transition. Specimens chilled below the transition point showed a completely gray structure which indicates that the graphite had formed during freezing at the transition point.

Further examination of the specimens showed graphite veins surrounded entirely by ledeburite which led Hanemann to conclude the graphite is precipitated directly from the melt.

What the Foundries Are Doing

Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

Glascock Stove & Mfg. Co., Greensboro, N. Y., will install a sandblast and an air compressor.

Ingersoll Milling Machine Co., Rockford, Ill., is building a pattern storage 48 x 162 feet, which will cost $5000.

The foundry of the Pekin Foundry & Mfg. Co., Pekin, Ill., recently was damaged slightly by fire.

Plant of the Atlantic Foundry Co., 182 Beaver street, Akron, O., recently was damaged by fire. Damage is estimated at $10,000 which was mostly to patterns.

Akron Foundry, Akron, Ind., has begun operations. A force of 20 men is employed and more are expected to be added as equipment arrives.

The name of the Sandwich Mfg. Co., Sandwich, Ill., has been changed to the New Idea Spreader Co. E. C. Mosher is vice president and works manager.

Central Foundry Co., 420 Lexington avenue, New York, is reported to be planning production of its products in Winnipeg, Man., Canada.

Bellaire Stove Co., Nineteenth and Union streets, Bellaire, O., has resumed operations after a shutdown of several weeks.

P. C. Gibson & Co., Waukegan, Ill., has changed its name to the Terminal Brass Co. P. C. Gibson is proprietor and works manager.

Negotiations for merging of the Goslin-Birmingham Mfg. Co. Inc., Birmingham, Ala., and the Fulton Iron Works Co., St. Louis, have been abandoned.

Ferrell Brass Foundry, 1646 Tarleton street, Los Angeles, is building an addition, 40 x 90 feet, to its foundry. The new construction will extend through to Compton avenue.

Chickasaw Machine & Foundry Co., 298 South Second street, Memphis, Tenn., has been adjudged bankrupt and the property has been acquired by H. N. Young, Corinth, Miss.

Robinson Foundry, Pekin, Ill., is establishing operations in a plant at Fourteenth and Ann Eliza streets, for the manufacture of brass and aluminum castings. Principal machinery has been acquired. C. E. Robinson is manager.

Anderson Foundry Co., 1725 West Carroll avenue, Chicago, has been incorporated with $20,000 capital by Mortimer Forges, City Hall Square building, to manufacture metal castings and operate a foundry.

Algonac Foundry Co., Algonac, Mich., has received a large order from the Robertson Construction Co., Benton Harbor, Mich., which includes castings and hardware for three government cruisers.

Jenkins Bros. Ltd., 617 St. Remi street, Montreal, Que., is reported to be planning expansions involving an eventual expenditure of $2,000,000. First structure under way is an iron and bronze foundry, 250 x 300 feet, to cost $500,000. (Noted Aug. 15.)

National Foundry & Pattern Co., 1721 Maypole avenue, Chicago, has been incorporated with $10,000 capital by Ehrhardt, Russell, Murphy & Quigley, 29 South LaSalle street, Chicago, to engage in general pattern shop and foundry business.

Livermon Boat Transport Co., Scotland Neck, N. C., has been organized by Carl R. Livermon and Charles J. Schields. The company is inquiring for steel and alloy castings for the manufacture of inboard and outboard power boats.

The plant of National-Erie Co., Erie, Pa., makers of steel castings and gears, suspended operations on Aug. 21. No prospective date was given for possible resumption of production. One report, however, was that refinancing would take place and that work might be started in September.

American Radiator Co., New York, has been awarded a contract for 20,000 cast iron radiators by the Metropolitan Square Corp., New York, for the radio center between Fifth and Sixth avenues, from Forty-eighth to Fifty-first streets. The total award will amount to 1650 tons approximately.

Oklahoma Valve & Equipment Co., Tulsa, Okla., is building a plant, 40 x 70 feet, near Tulsa which will contain a machine shop and nonferrous foundry. Industrial and oil field valves will be manufactured. The company recently was organized with Benjamin P. Hoffman as president and Beryl Hoffman as secretary-treasurer.

The Welland, Ont., plant formerly owned by Robert S. Hart, Hamilton, Ont., has been sold to the American Manganese Steel Co. The plant has been idle for several years. It is said the new owners will reopen the plant shortly after installing equipment to cost more than $200,000. The plant has 11 acres and a main manufacturing building 80 feet x 500 feet.

The Almont Mfg. Co., Almont, Mich., has purchased an interest in the Hurd Lock Co., Detroit. Officers of the Hurd company now are E. P. Hurd, president and general manager; P. W. Mudler, vice president; and C. D. Ferguson, secretary and treasurer. Those officers with R. K. Westcott are members of the board of directors. The Almont company has concentrated its foundry activities at its Imlay City, Mich., plant. The Almont, Mich., plant has been remodeled and will be occupied by the Hurd Lock Co.

Derby Castings Co., which formerly rented quarters at 54 Commerce street, Derby, Conn., has purchased the Seymour, Conn., plant of the Farrel-Birmingham Co. Inc., Ansonia, Conn., containing 15,000 square feet of floor space. The new location has been renovated to suit the needs of the new owners who now are operating at that location. Officers of the company include S. C. Conlon, president; C. H. Stokesbury, treasurer; and J. W. Beecher, secretary. N. H. Whipple, formerly associated with the Whipple & Choate Co. and the Bridgeport Deoxidized Bronze & Metal Co., Bridgeport, Conn., has acquired an interest in the business and is acting as sales manager.

RAW MATERIAL PRICES

Sept. 8, 1931

Iron	
No. 2 foundry, Valley	$17.00
No. 2 Southern, Birmingham	12.00
No. 2 foundry, Chicago	17.50
No. 2 foundry, Buffalo	17.00
Basic, Valley	17.00
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	17.50
Malleable, Buffalo	17.50
Coke	
Connellsville Beehive coke	$3.25 to 4.50
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$10.50 to 11.00
Heavy melting steel, Pitts.	10.50 to 11.50
Heavy melting steel, Chicago	8.00 to 8.50
Stove plate, Buffalo	8.25 to 8.50
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	7.50 to 8.00
No. 1 cast, Chicago	8.75 to 9.25
No. 1 cast, Philadelphia	11.50 to 12.50
No. 1 cast, Pittsburgh	10.00 to 10.50
No. 1 cast, Birmingham	9.00 to 10.00
Car wheels, iron, Pittsburgh	11.00 to 11.50
Car wheels, iron, Chicago	9.50 to 10.00
Railroad malleable, Chicago	8.50 to 9.00
Agricultural mal., Chicago	8.00 to 8.50
Malleable, Buffalo	10.00 to 10.50
Nonferrous Metals	
	Cents per pound
Casting copper, refinery	7.25
Straits tin	25.75
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt	9.00 to 10.50
Lead, New York	4.40
Antimony, New York	6.60
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.80

Trade Publications

TRUCK WHEELS—A folder recently issued by Divine Bros. Co., Utica, N. Y., describes canvas cushion truck wheels made by the company. Long life and smooth service are emphasized. An illustration shows the construction.

SAND TESTER—A motor driven pulling device for testing the bonding or cohesiveness of molding sand is illustrated and described in a recent bulletin from Reynolds Electric Co., 2650 West Congress street, Chicago. Advantages of the equipment are pointed out.

SAND PREPARATION—Sand rubbing machines of the Universal System of Machine Moulding & Machinery Co. Ltd., London, England, are described in a recent illustrated bulletin. Technical details of operation are described and production advantages emphasized.

PLANT CAFETERIAS — Factory Stores Co., Cleveland, has prepared a booklet describing the value of its plan of operation of cafeterias in industrial plants as a means of serving the welfare of workers. In such units established by this company 5,000,000 meals were served in 1930.

GYRATING SCREENS—An illustrated catalog recently issued by Robins Conveying Belt Co., 15 Park row, New York, describes various models gyrating screens. Details of design and operation are outlined, engineering specifications are given, and illustrations show typical applications, among which are screening foundry sands and removal of dust.

WHERE-TO-BUY

A classified list of advertisers according to products. ¶Index to advertisements give page number of any advertiser.

ABRASIVE WHEELS

Safety Grinding Wheel & Machine Co., Springfield, O.

ABRASIVES—Metallic

American Steel Abrasives Co., Galion, O.
Globe Steel Abrasive Co., Dept. F., Mansfield, O.
Patch-Wegner Co., Inc., Rutland, Vt.
Philadelphia Steel Abrasive Co., The, East of Lewis & Ashland Sts., Frankford, Philadelphia, Pa.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.
Steel Shot & Grit Co., Amesbury, Mass.
Steelblast Abrasives Co., 6536 Carnegie Ave., Cleveland, O.

ACETYLENE DISSOLVED OR IN CYLINDERS

Linde Air Products Co., 30 E. 42nd St., New York City.

ACETYLENE GENERATING APPARATUS

Linde Air Products Co., 30 E. 42nd St., New York City.

AIR COMPRESSORS

General Electric Co., Schenectady, N. Y.

ALKALI

Mathieson Alkali Wks., Inc., The, 250 Park Ave.,New York City.

ALLOYS

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

ALUMINUM

British Aluminium Co., Ltd., 122 E. 42nd St., New York City.

ALUMINUM—Alloys and Ingots

British Aluminium Co., Ltd., 122 E. 42nd St., New York City.

ARC WELDING EQUIPMENT

General Electric Co., Schenectady, N. Y.

ARCHITECTS—Industrial

Austin Co., The, 16112 Euclid Ave., Cleveland, O.

ARRESTORS & COLLECTORS—Dust—See Dust Arresting and Collecting Systems

BABBITT METAL

Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BARS (Steel)

Bethlehem Steel Co., Bethlehem, Pa.

BELLOWS—Molders

Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

BLOWERS

General Electric Co., Schenectady, N. Y.

BOLTS AND NUTS

Bethlehem Steel Co., Bethlehem, Pa.

BOOKS—Technical

Penton Publishing Co., Cleveland.

BOTTOM PLATES—Steel

Shanafelt Mfg. Co., Canton, O.
Truscon Steel Co. (Pressed Steel Div.) 6100 Truscon Ave., Cleveland, O.

BRONZE—Manganese

Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BRUSHES—Foundry

Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

BRUSHES—Motor and Generator

General Electric Co., Schenectady, N. Y.
United States Graphite Co., The, Saginaw, Mich.

BUCKET CARRIERS—Pivoted

Milwaukee Electric Crane & Hoist Corp., Milwaukee, Wis.

BUCKETS

Penn Foundry & Mfg. Co., Reading, Pa.

BUCKETS—Clamshell, Dragline, Grab

Brosius, Edgar E., Inc., 19th St. & P. R. R., Sharpsburg P. O., Pittsburgh, Pa.
Harnischfeger Corp., 3800 National Ave., Milwaukee, Wis.

BUCKETS—Line

Milwaukee Electric Crane & Hoist Corp., Milwaukee, Wis.

BUILDINGS—Foundry, Factory, Industrial

Austin Co., The, 16112 Euclid Ave., Cleveland, O.

BURNERS—Oil or Gas

Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.

BUSHINGS—Flask Pin

Michigan Screw Co., Lansing, Mich.

CALCIUM—SILICON

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

CALCIUM CARBIDE

Linde Air Products Co., 30 E. 42nd St., New York City.

CALKING HAMMERS—Pneumatic

Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

CARBIC

Linde Air Products Co., 30 E. 42nd St., New York City.

CARBIDE

Linde Air Products Co., 30 E. 42nd St., New York City.

CARS—Platform, Industrial Railway, Transfer, Narrow Gage

Bethlehem Steel Co., Bethlehem, Pa.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Penn Foundry & Mfg. Co., Reading, Pa.

CARS—Sandblast

Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.

CARS & LOCOMOTIVES—Industrial

Industrial Equipment Co., The, Minster, O.

CASTINGS (Gray Iron)

Bethlehem Steel Co., Bethlehem, Pa.

CEMENT—High Temperature, Refractory

Alpha-Lux Co., Inc., 192 Front St., New York City.
Lava Crucible Co. of Pittsburgh, Wabash Bldg., Pittsburgh, Pa.

CEMENT—Metallic

Shanafelt Mfg. Co., Canton, O.

CHAPLETS

Shanafelt Mfg. Co., Canton, O.

CHARGING EQUIPMENT—Air Furnace

Euclid Crane & Hoist Co., The, 1364 Chardon Rd., Euclid, Ohio.

CHEMICALS

Mathieson Alkali Wks., Inc., The, 250 Park Ave., New York City.

CHISEL BLANKS—Pneumatic

Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

CHROMIUM

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

CINDER MILLS

Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.

COAL

Hanna Furnace Corp., The, Detroit, Mich.

COAL CRUSHERS and Pulverizers

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

COAL—ORE—ASH HANDLING MACHINERY

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Harnischfeger Corp., 3800 National Ave., Milwaukee, Wis.
Milwaukee Electric Crane & Hoist Corp., Milwaukee, Wis.

COKE

Bethlehem Steel Co., Bethlehem, Pa.
Hanna Furnace Corp., The, Detroit, Mich.
Semet-Solvay Co., 61 Broadway, New York City.

CONVEYERS—Belt

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

CONVEYING AND ELEVATING EQUIPMENT

Arcade Mfg. Co., Dept. D., Freeport, Ill.
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Cleveland Electric Tramrail Div. of Cleveland Crane & Eng. Co., Wickliffe, O.
Jeffrey Mfg. Co., The, Columbus, O.
National Engineering Co., 549 W. Washington Blvd., Chicago.
Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

CORE BINDERS

Corn Products Refining Co., 17 Battery Place., New York City.
Pennsylvania Lubricating Co., 34th & Smallman Sts., Pittsburgh.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.

CORE BREAKERS

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

CORE COMPOUNDS

Corn Products Refining Co., 17 Battery Place, New York City.
Lindsay-McMillan Co., 930 S. Water St., Milwaukee, Wis.
Pennsylvania Lubricating Co., 34th & Smallman Sts., Pittsburgh.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.

CORE MAKING MACHINES

Arcade Mfg. Co., Dept. D, Freeport, Ill.
Demmler, Wm., & Bros., Kewanee, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh.
International Molding Machine Co., 2616 W. 16th St., Chicago, Ill.
Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.
Tabor Mfg. Co., The, 6225 Tacony St., Philadelphia, Pa.

CORE OIL

Lindsay-McMillan Co., 930 S. Water St., Milwaukee, Wis.
Pennsylvania Lubricating Co., 34th & Smallman Sts., Pittsburgh.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.

CORE OVENS—See Ovens—Core-Mold

CORE RACKS

Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Truscon Steel Co. (Pressed Steel Div.) 6100 Truscon Ave., Cleveland, O.

CORE RODS

Franklin Core Rod & Gagger Co., Franklin, Pa.

CORE ROOM EQUIPMENT

Truscon Steel Co. (Pressed Steel Div.) 6100 Truscon Ave., Cleveland, O.

CORE SAND MIXERS

National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.